Weston & Sampson

westonandsampson.com

273 Dividend Road
Rocky Hill, CT 06067
tel: 860.513.1473

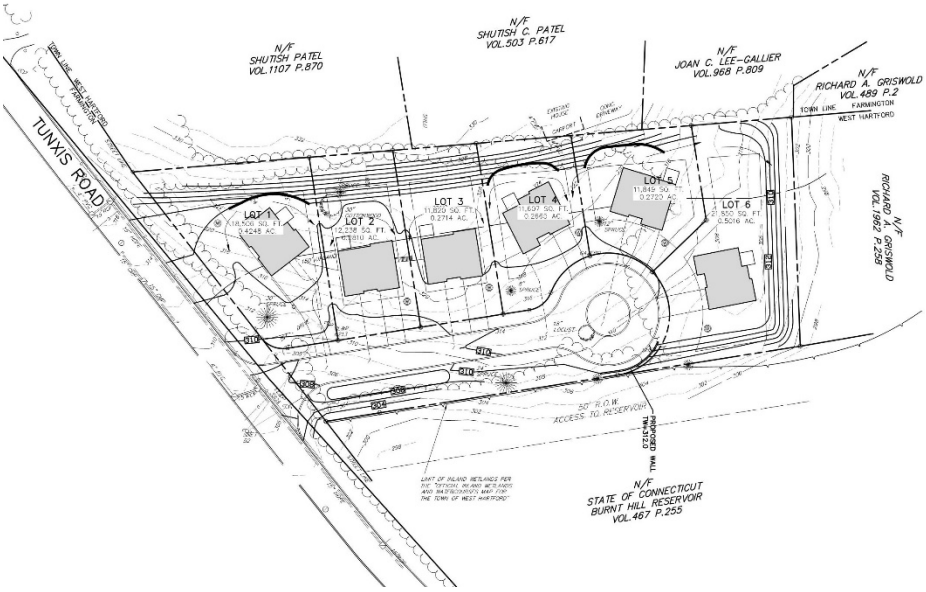
REPORT

January 2018

Stormwater Management Report

Prepared for:
The Bongiovanni Group

Site Location:
380 Tunxis Road
West Hartford, Connecticut



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1.0 INTRODUCTION

Weston & Sampson is pleased to submit this Stormwater Management Report on behalf of the applicant. A six (6) lot residential subdivision is proposed at 380 Tunxis Road in West Hartford, CT. The 2.6 acre property is located on the north side of Tunxis Road and is bordered by the Farmington Town line/residential properties to the west, a residential property to the north, and a State owned property associated with the Burnt Hill Reservoir to the east. Refer to the Location Plan in Appendix A.

A 380 linear foot private road and cul-de-sac is proposed to provide direct access from Tunxis Road to the residential properties. The site development will also include curbing, bituminous concrete driveways, landscaping, utilities, retaining walls, and a stormwater management system.

2.0 DESIGN METHODOLOGIES

All storm drainage has been designed in accordance with the State of Connecticut, Department of Transportation, Drainage Manual. The Rational Method was used for the development of all peak flows. A minimum time of concentration of 5 minutes was used for all paved areas. All other times of concentration were calculated using the TR-55 method. Precipitation records for each design storm are taken from NOAA Atlas 14, Volume 10, Version 2, Precipitation Frequency Data Server for West Hartford, CT. Runoff coefficients of 0.3 (Lawns), and 0.9 (Pavement and Roofs) were used for the storm drainage design

The Hydraflow Storm Sewers program was used for the analysis of storm sewer pipe flow, gutter-flow, and hydraulic grade line. The roadway storm sewer system has been designed with the capacity necessary to convey the 10-year frequency design storm. The storm sewer system design can be found in Appendix C.

The Hydraflow Hydrographs program was used for pre-development and post-development analysis of the various drainage areas including the routing of hydrographs through the proposed subgrade detention system. This system has been designed with the capacity necessary to convey and control the 100-year frequency design storm. The Pre and Post-Development Hydrograph Analysis as well as the design of the proposed subgrade detention system pond can be found in Appendix B.

3.0 PRE-DEVELOPMENT SITE CONDITIONS

The existing property is mostly lawn with some wooded areas to the north and has an existing home with paved driveway.

The existing site is divided into three (3) pre-development drainage areas as follows (See Figures 1 and 2 in Appendix A):

Pre-Development A:	Runoff from the southern portion of site generally flows in a southeasterly direction to a Discharge Point located at an existing catch basin located on Tunxis Road.
Pre-Development B:	Runoff from the majority of the project site generally flows in an easterly direction to a Discharge Point located along the eastern property boundary. It is important to note that offsite runoff enters the 380 Tunxis Road property from the west and contributes to pre-development area "B".
Pre-Development C:	Runoff from the northern portion of the property generally flows in a northeasterly direction to a Discharge Point located along the northern property boundary. It is important to note that offsite runoff enters the 380 Tunxis Road property from the west and contributes to pre-development area "C".

A summary of the pre-development peak runoff rates can be seen in Table 1.

4.0 POST-DEVELOPMENT SITE CONDITIONS

The post-development watersheds have been divided into three (3) drainage areas for the purposed of comparing peak rates of runoff with that of pre-development, and can be seen in Figure 3 in Appendix A.

Roadway and site runoff will be controlled by standard CTDOT (Type C Top) catch basins and shall discharge to a subgrade detention system. Roof runoff will be allowed to sheet flow overland. Hoods are proposed over outlet piping within catch basins to provide additional entrapment of debris and floatables. All proposed piping is high density polyethylene (HDPE) and has been sized to control the 10-year design storm. The layout of the system along with pipe sizes and lengths, inverts, top of frames, etc. can be seen on the "Drainage Schematic" or Figure 5 in Appendix A. The storm sewer calculations, which includes pipe hydraulics, gutter-flow analysis, and hydraulic grade line analysis can be seen in the Hydraflow results presented in Appendix C.

Prior to entering the subgrade detention system, pre-treatment shall occur from the combined use of 2' and 4'-deep sumps catch basins and a water quality structure (WQS-1). This structure is designed to treat the majority of site runoff and is specified to be a hydrodynamic separator from the CTDOT list of approved products. The structure is capable of removing 80% of total suspended solids (TSS) as well as preventing migration of oils and other floatables. Refer to Appendix D for water quality flow (WQF) and bypass sizing calculations for the proposed water quality structure. The first-flush of site runoff shall also be directed through the detention system "isolator row". The isolator chamber row is wrapped in a non-woven geotextile, which is designed to capture any additional sediment that has not been captured in the upstream measures. The subgrade detention system is a chamber-type system surrounded by crushed stone and wrapped in filter fabric (See Figure 6 in Appendix A). The system has not been designed for infiltration as an added factor of safety, but it is likely that some infiltration will occur. A proposed outlet control structure will release the detention system discharge at a reduce peak rate of runoff (See Figure 7 in Appendix A). A modified riprap splashpad will provide outlet

protection while a modified riprap level-spreader will further reduce discharge velocities and convert concentrated runoff to sheet-flow prior to discharging runoff to the adjacent wetlands to the east. These measures are consistent with procedures indicated in the Connecticut Stormwater Quality Manual. It is anticipated that the combination of these structural BMP's will be most effective in controlling and eliminating sediment, oil and grease, leaves and grass clippings, and seasonally elevated runoff temperatures.

5.0 EROSION & SEDIMENTATION CONTROL MEASURES

In order to protect the adjacent properties and resource areas from construction related activities, a Soil Erosion and Sediment Control Plan has been developed in accordance with the latest Connecticut Guidelines for Soil Erosion and Sediment Control. This plan will be implemented prior to the start of any site disturbance and will involve the combined use of perimeter silt fencing, hay bale barriers, an anti-tracking pad, and vegetative stabilization. Refer to design plans for soil erosion and sediment control notes, construction sequence, and details.

Once a contractor has been selected and a construction schedule has been established a person shall be named and will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials, installation, and maintenance of erosion and sediment structures, the communication and detailed explanation to all people involved in the site work of the requirements and objective of the erosion and sediment control measures.

Weston and Sampson (860) 513-1473 located at 273 Dividend Road, Rocky Hill, Connecticut, 06067 shall be notified of any proposed alteration to the erosion and sediment control plan, prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

An Operation and Maintenance Plan has been prepared for the proposed erosion and sediment control measures during the construction of the stormwater system. This plan shall be implemented at the onset and throughout construction activities until the project is complete. This plan provides guidelines for when the stormwater system should be cleaned, and associated record keeping and can be found in Appendix E.

6.0 SUMMARY

A Pre & Post Development analysis (Appendix B) has been performed to show that the total peak flow rate for the 2 thru 100-year design storms has not increased over that of pre-development. A summary of the pre and post-development peak flow rates for each Subarea is shown below in Table 1:

Table 1
Pre and Post-Development Peak Flows

	2-year, 24-hour storm		10-year, 24-hour storm		25-year, 24-hour storm		50-year, 24-hour storm		100-year, 24-hour storm	
Drainage Subareas	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**
A	0.63	0.65	0.95	0.99	1.15	1.20	1.31	1.37	1.47	1.53
B	2.13	1.26*	3.23*	2.29*	3.93*	2.92*	4.46*	3.38*	5.01*	4.35*
C	0.85	0.69	1.30	1.05	1.58	1.28	1.79	1.45	2.01	1.62
Total	**3.61**	**2.60**	**5.48**	**4.33**	**6.66**	**5.40**	**7.56**	**6.20**	**8.49**	**7.50**

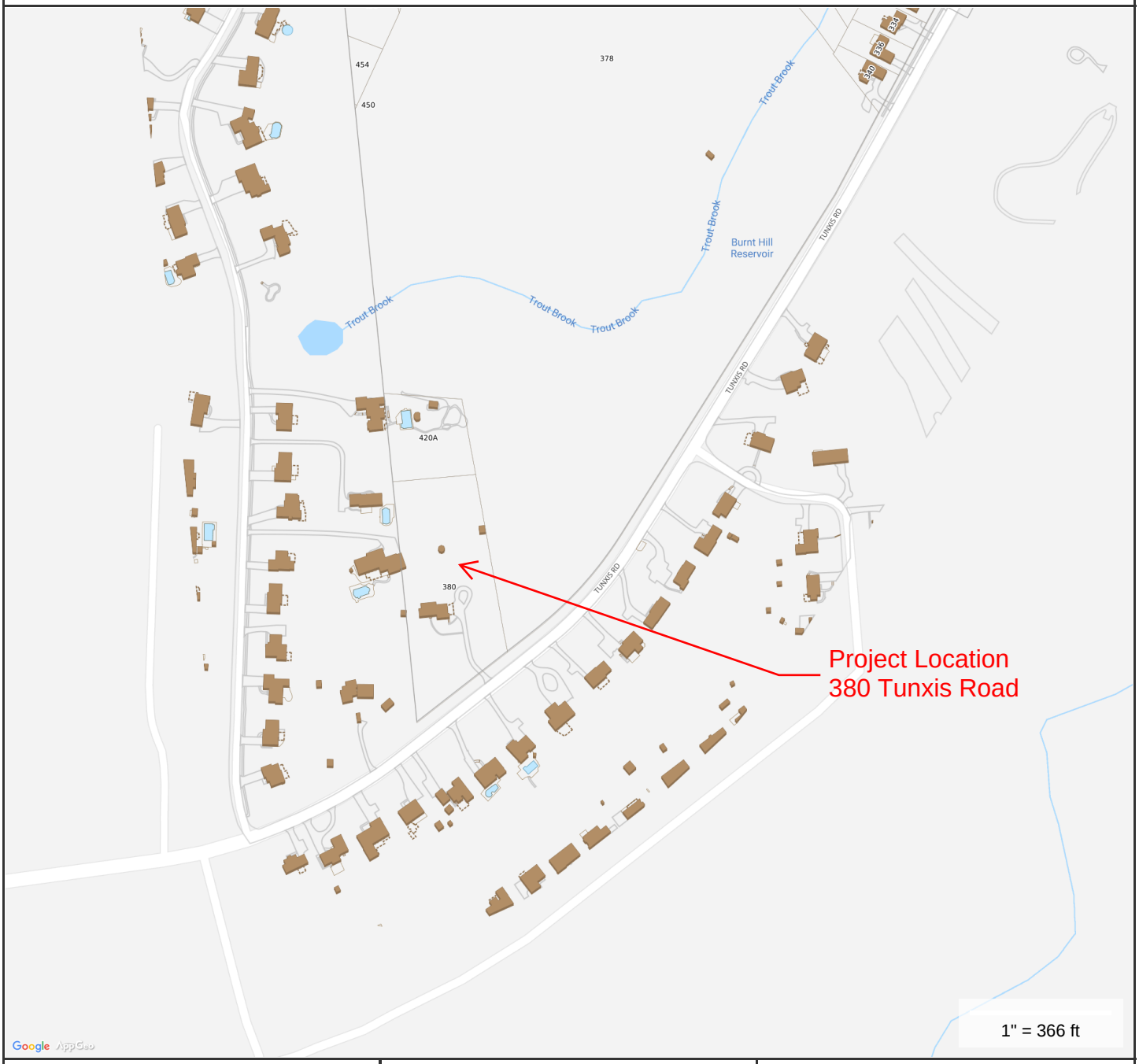
* Peak flow represents that which is reduced/mitigated as a result of detention.

It can be seen from the results in Table 1, that the proposed Stormwater Management System will effectively serve to mitigate the effects of the proposed site improvements. The total post-development peak flow for the various design storms is below that of pre-development. We would consider these results to be conservative since infiltration within the subgrade detention system has not been accounted for in the design and that the post-development peak flows may likely be lower than those indicated in this report.

APPENDIX A

Figures

Location Map



TOWN OF WEST HARTFORD

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

Town of West Hartford, CT makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 8/1/2018
Data updated Daily

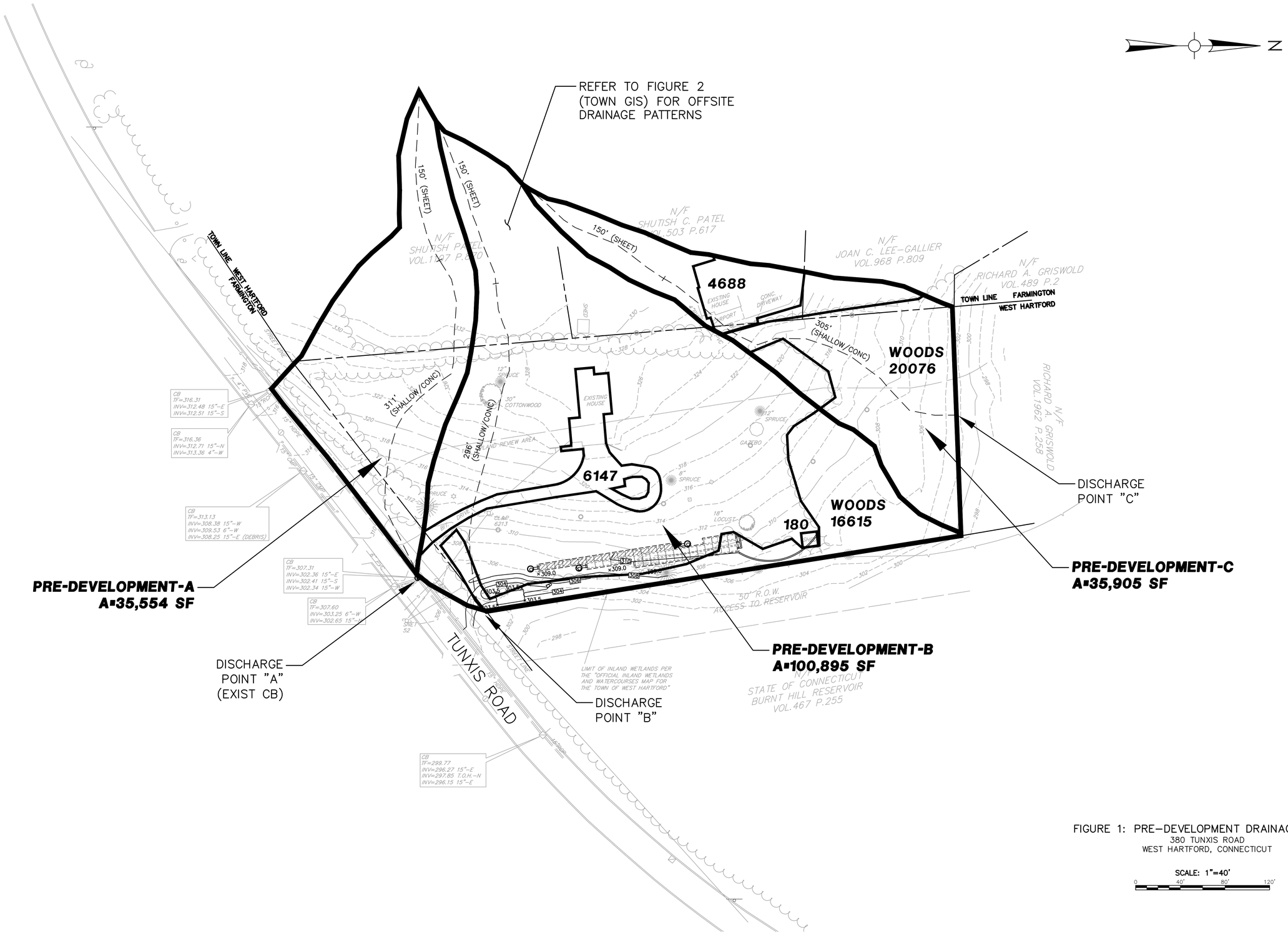
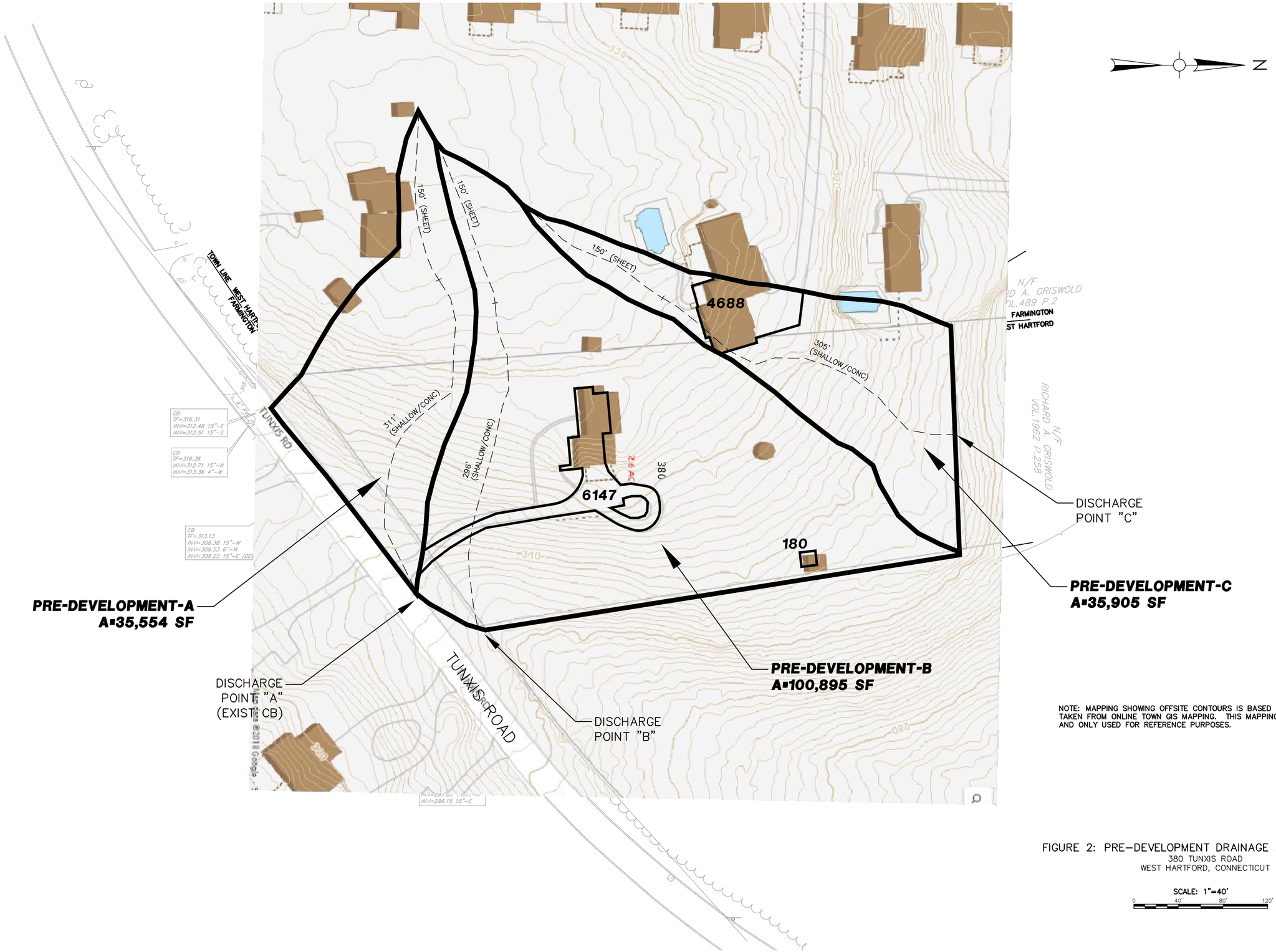


FIGURE 1: PRE-DEVELOPMENT DRAINAGE AREAS
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'



NOTE: MAPPING SHOWING OFFSITE CONTOURS IS BASED ON TOPOGRAPHY TAKEN FROM ONLINE TOWN GIS MAPPING. THIS MAPPING IS APPROXIMATE AND ONLY USED FOR REFERENCE PURPOSES.

FIGURE 2: PRE-DEVELOPMENT DRAINAGE AREAS (OFFSITE)
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'

0 40' 80' 120'

N

REFER TO FIGURE 2
(TOWN GIS) FOR OFFSITE
DRAINAGE PATTERNS

TOWN LINE WEST HARTFORD
FARMINGTON

TOWN LINE FARMINGTON
WEST HARTFORD

150' (SHEET)

121'
(SHALLOW/CONC)

70' (SHEET)

160'
(SHALLOW/CONC)

186'
(SHALLOW/CONC)

149' (SHALLOW/CONC)

39' (SHALL/CONC)

76' (SHALL/CONC)

CB
TF=316.31
INV=312.48 15"-E
INV=312.51 15"-S

CB
TF=316.36
INV=312.71 15"-N
INV=313.36 4"-W

CB
TF=313.13
INV=308.38 15"-W
INV=309.53 6"-W
INV=308.25 15"-E (DEBRIS)

CB
TF=307.31
INV=302.36 15"-E
INV=302.41 15"-S
INV=302.34 15"-W

CB
TF=307.60
INV=303.25 6"-W
INV=302.65 15"-W

CB
TF=299.77
INV=296.27 15"-E
INV=297.85 T.O.H.-N
INV=296.15 15"-E

TUNXIS ROAD

50' R.O.W.
ACCESS TO RESERVOIR

I.P. FOUND
OFF 0.67'-W

PROPOSED WALL
TW=312.0

I.R. FOUND

TOWN LINE
MON. FOUND

EXISTING HOUSE

CARPORT

SHED

CARPORT & 4"PVC
SUBDRAIN ONLY

DISCHARGE
POINT "A"
(EXIST CB)

DISCHARGE
POINT "B"

DISCHARGE
POINT "C"

POST-DEVELOPMENT-A
A=25,126 SF

POST-DEVELOPMENT-C
A=23,685 SF

POST-DEVELOPMENT
SUBAREA-B1
A=110,604 SF

POST-DEVELOPMENT
SUBAREA-B2
A=13,389 SF

FIGURE 3: POST-DEVELOPMENT DRAINAGE AREAS
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'

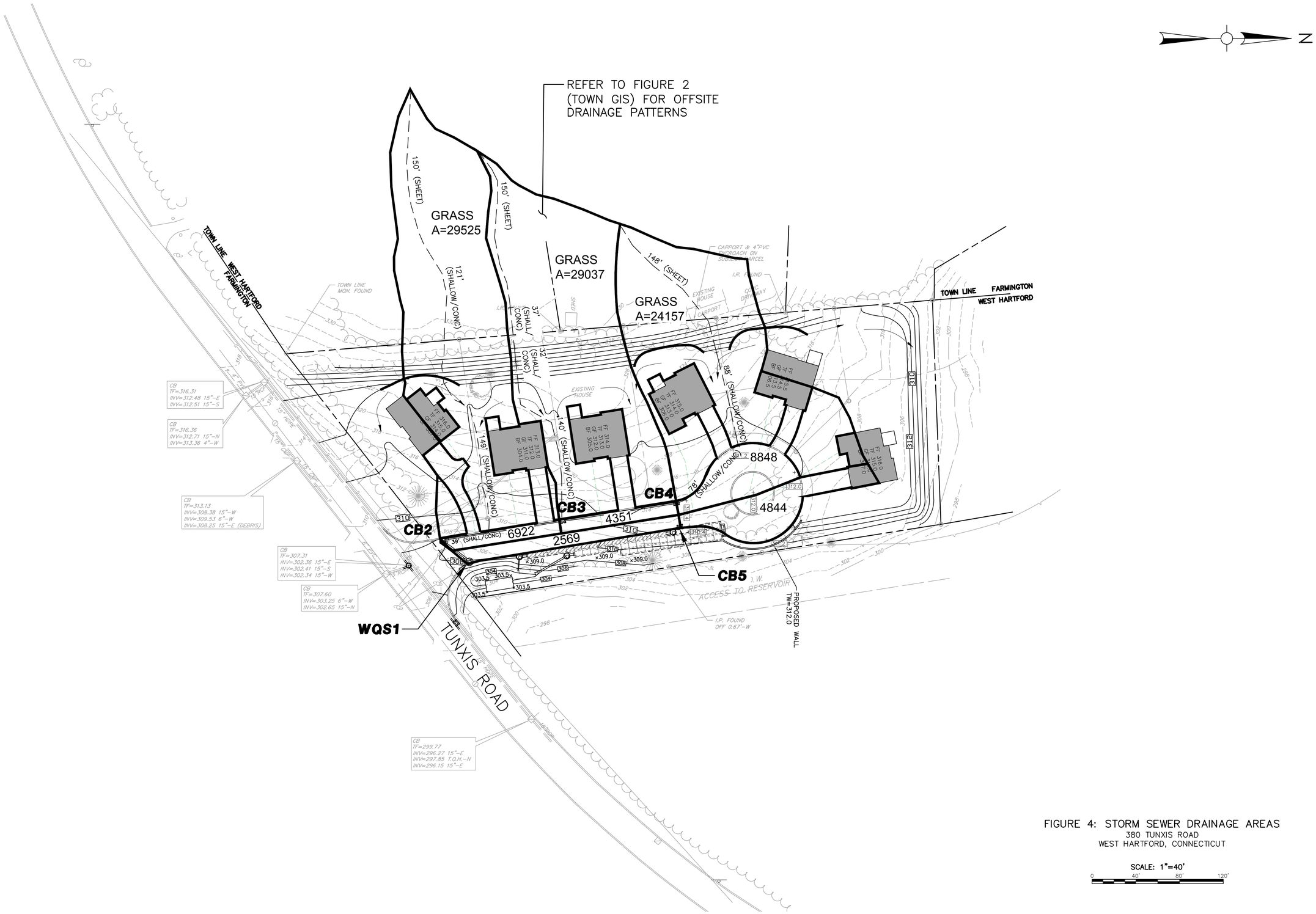
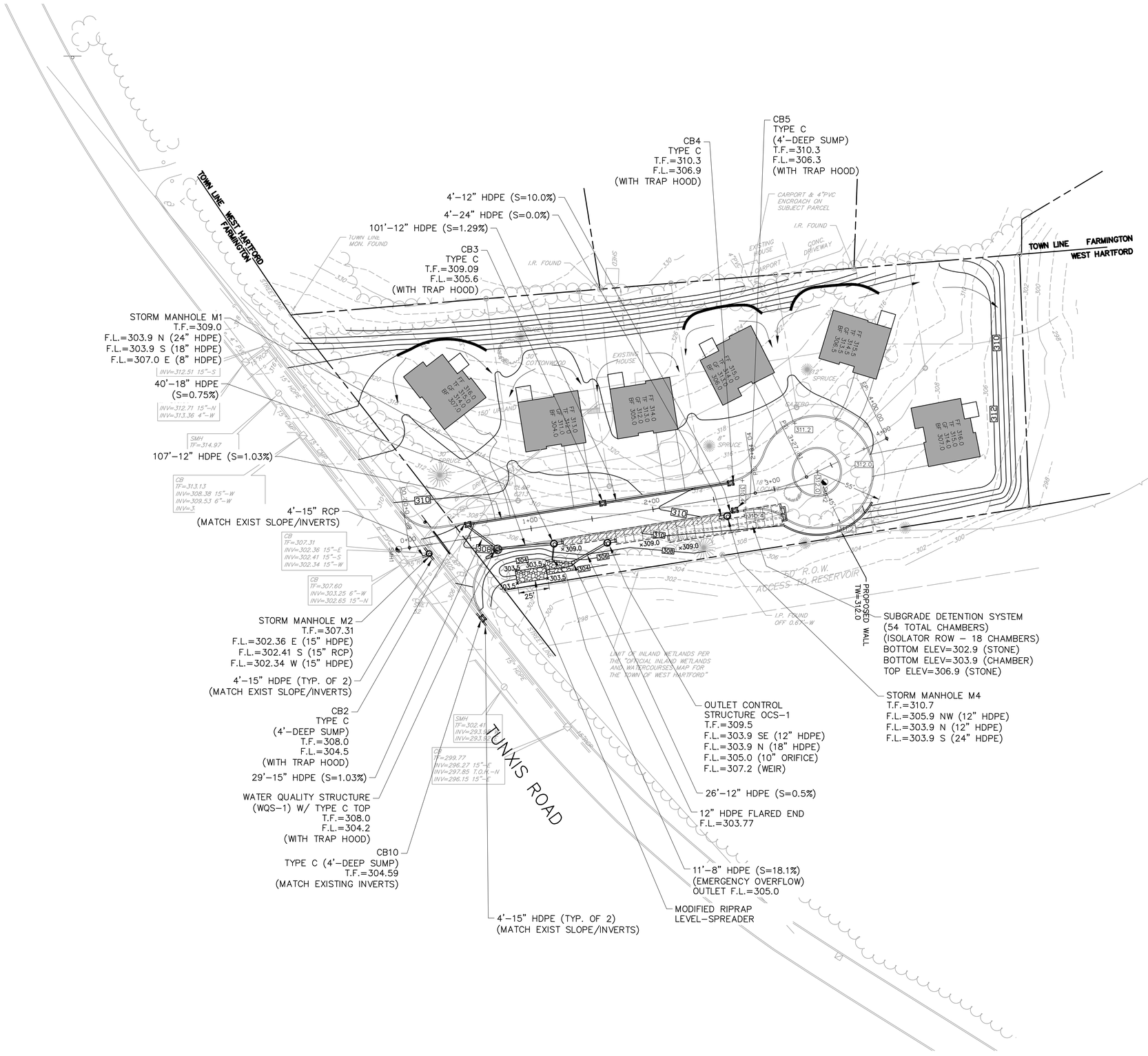


FIGURE 4: STORM SEWER DRAINAGE AREAS
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'



NOTES:

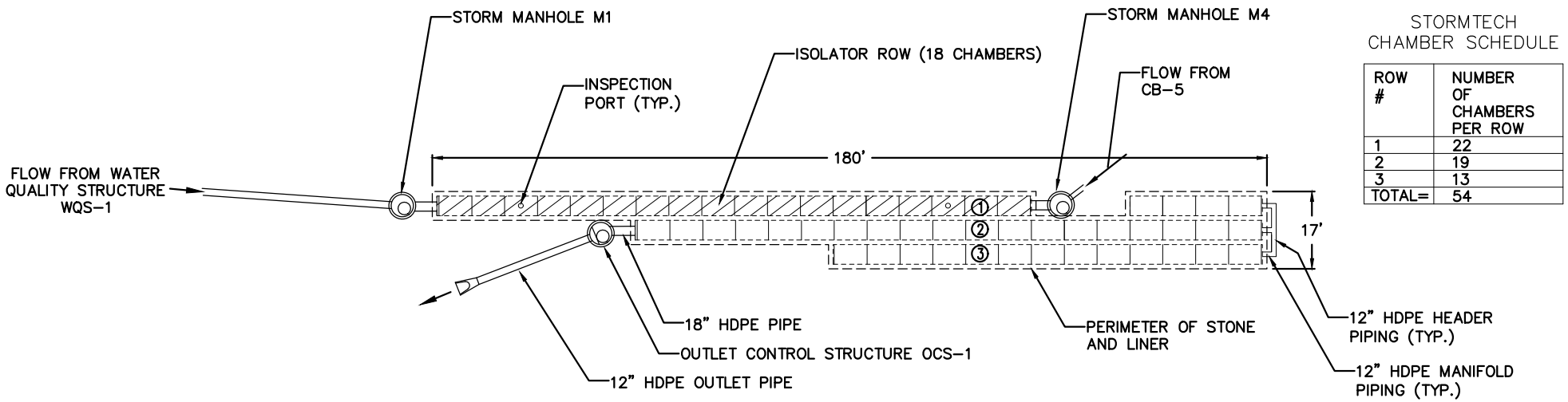
1. ALL HIGH DENSITY POLYETHYLENE (HDPE) STORM DRAINAGE PIPING SHALL BE SHALL BE IN CONFORMANCE WITH ASTM D.3350. REINFORCED CONCRETE PIPE SHALL CONFORM TO CONNDOT MATERIAL SPECIFICATION SECTION M.08.01(6).
2. ALL CATCH BASINS SHALL HAVE 2' DEEP SUMPS UNLESS NOTED OTHERWISE.
3. REFER TO CONSTRUCTION SEQUENCE FOR INSTALLATION OF SEDIMENTATION AND EROSION CONTROL MEASURES.
4. SUBGRADE DETENTION SYSTEM SHALL BE MANUFACTURED BY STORMTECH, OR APPROVED EQUAL. ANY SUBTSITUTION SHALL BE REVIEWED AND APPROVED BY THE DESIGN ENGINEER.
5. ALL CATCH BASINS SHALL BE FITTED WITH CATCH BASIN INLET PROTECTION DURING CONSTRUCTION.
6. ALL PROPOSED STORM DRAINAGE OUTLET PIPES AT CATCH BASINS SHALL BE FITTED WITH DEBRIS (TRAP) HOODS. HOODS SHALL BE A "SNOUT", MANUFACTURED BY BEST MANAGEMENT PRODUCTS INC., (800) 504-8008, OR APPROVED EQUAL.
7. WATER QUALITY STRUCTURE (WQS-1) SHALL BE DESIGNED TO TREAT A WATER QUALITY FLOW = 0.4 CFS AND BYPASS A DESIGN FLOW =4.9 CFS. THE STRUCTURE SHALL BE HAVE A CTDOT TYPE C FRAME AND GRATE. THE STRUCTURE SHALL BE A CONTECH© MODEL CDS2015-4, SHALL BE A MODEL AND MANUFACTURER FROM THE CTDOT LIST OF APPROVED HYDRODYNAMIC SEPARATORS.

FIGURE 5: DRAINAGE SCHEMATIC

380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'

0 40' 80' 120'

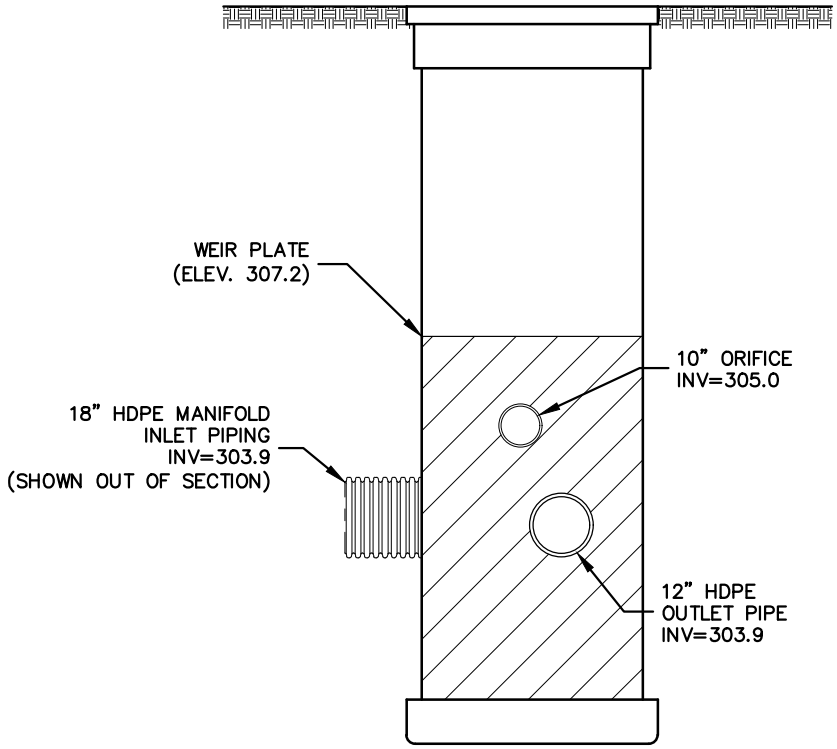


STORMTECH CHAMBER SCHEDULE

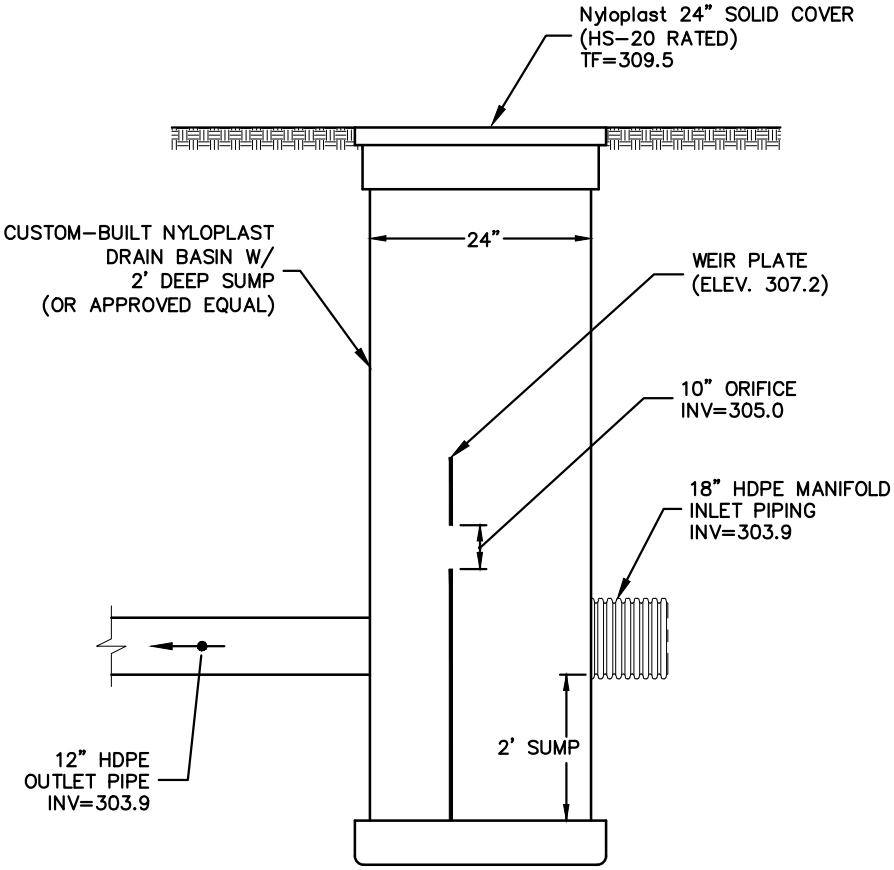
ROW #	NUMBER OF CHAMBERS PER ROW
1	22
2	19
3	13
TOTAL=	54

FIGURE 6: SUBGRADE DETENTION SYSTEM SCHEMATIC

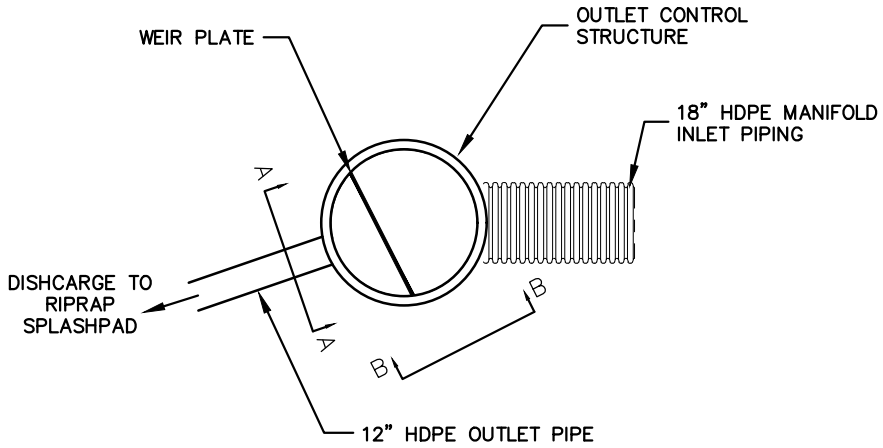
N.T.S.



SECTION A–A



SECTION B–B



PLAN

FIGURE 7: OUTLET CONTROL STRUCTURE AND PIPING DETAIL

N.T.S

APPENDIX B

Pre and Post-Development Analysis (Detention System Design)

SUBJECT	380 Tunxis Rd		SHEET NO.	1	OF 1
	Pre and Post Development		COMPUTED BY	BH	DATE 12/10/2018
JOB NO.	2180652		CHECKED BY	JSP	DATE 12/10/2018

DATA SHEET FOR RATIONAL METHOD STORM DRAINAGE DESIGN

Q = CiA

NODE		AREA	RUNOFF COEFFICIENT C			TIME OF CONCENTRATION (TR-55)					
AREA I.D.	AREA (S.F.)	ACRES	DESCRIPTION	C VALUE	TOTAL AC	ELEV. DIFF. FT	LENGTH FT	SLOPE %	COVER	TIME MIN.	Flow Type
PRE-	35554	0.816	GRASS	0.3	0.245	5	150	3	Grass	16.76	Sheet
DEVELOP	0	0.000	IMPERVIOUS	0.9	0.000	35	311	11	Grass	0.97	Shallow
A	0	0.000	WOODS	0.2	0.000						
						(Tc Calulation from Hydraflow)				17.73	(Total)
	TOTAL	0.816		0.30							
PRE-	77953	1.790	GRASS	0.3	0.537	8	150	5	Grass	13.66	Sheet
DEVELOP	6327	0.145	IMPERVIOUS	0.9	0.131	35	296	12	Grass	0.88	Shallow
B	16615	0.381	WOODS	0.2	0.076						
						(Tc Calulation from Hydraflow)				14.54	(Total)
	TOTAL	2.316		0.32							
PRE-	11141	0.256	GRASS	0.3	0.077	13	150	9	Grass	10.8	Sheet
DEVELOP	4688	0.108	IMPERVIOUS	0.9	0.097	28	305	9	Grass	1.05	Shallow
C	20076	0.461	WOODS	0.2	0.092						
						(Tc Calulation from Hydraflow)				11.85	(Total)
	TOTAL	0.824		0.32							

SUBJECT	380 Tunxis Rd		SHEET NO.	1	OF 1
	Post Development		COMPUTED BY	BH	DATE 12/10/2018
JOB NO.	2180652		CHECKED BY	JSP	DATE 12/10/2018

DATA SHEET FOR RATIONAL METHOD STORM DRAINAGE DESIGN

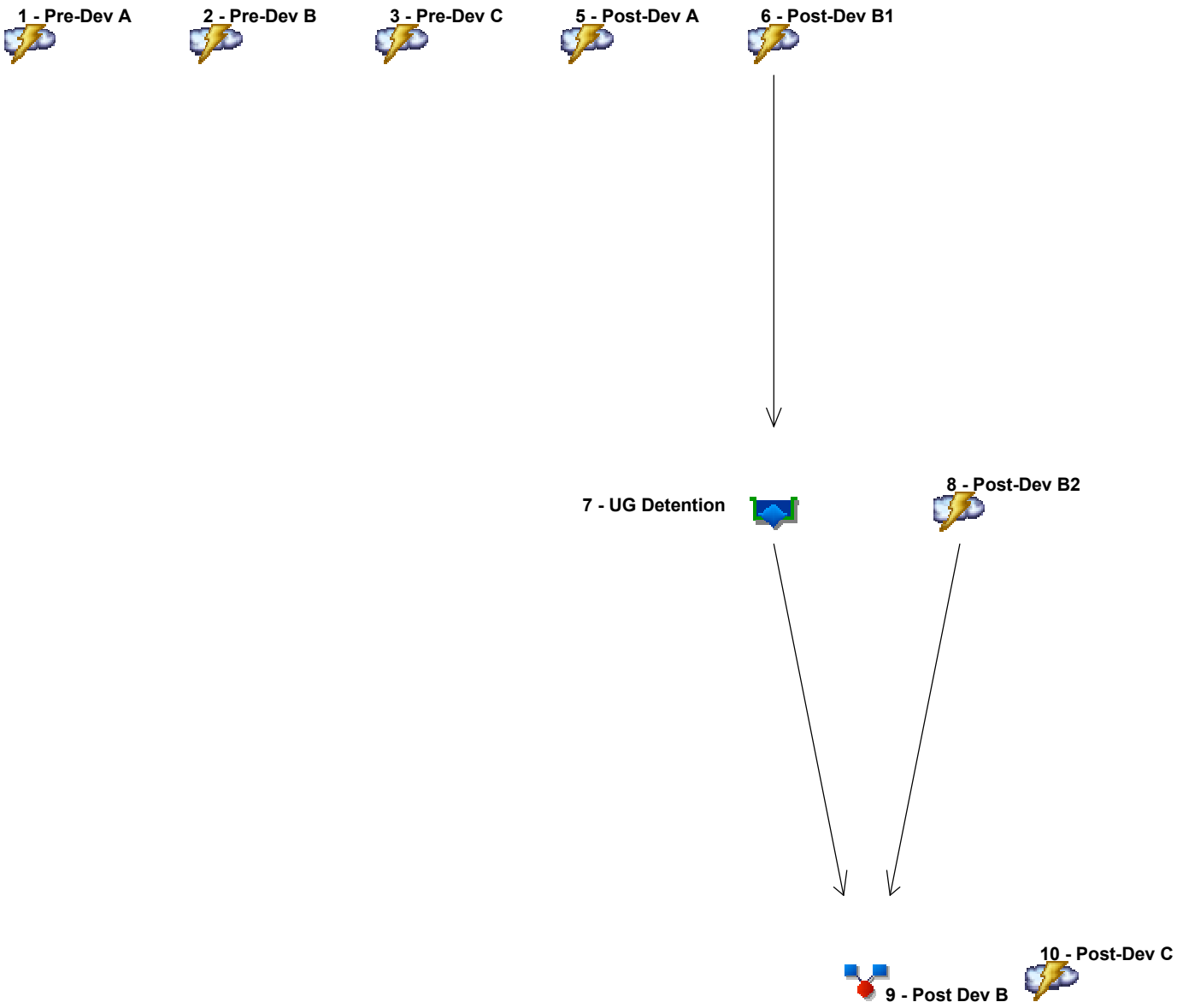
Q = CiA

NODE		AREA	RUNOFF COEFFICIENT C			TIME OF CONCENTRATION (TR-55)					
AREA I.D.	AREA (S.F.)	ACRES	DESCRIPTION	C VALUE	TOTAL AC	ELEV. DIFF. FT	LENGTH FT	SLOPE %	COVER	TIME MIN.	Flow Type
POST	23156	0.532	GRASS	0.3	0.159	13	150	9	Grass	10.8	Sheet
DEVELOP	1970	0.045	IMPERVIOUS	0.9	0.041	15	189	8	Grass	0.69	Shallow
A						3	76	4	Impv	0.31	Shallow
						(Tc Calulation from Hydraflow)				11.8	(Total)
TOTAL	25126	0.577		0.35							
POST	83574	1.919	GRASS	0.3	0.576	5	150	3	Grass	16.76	Sheet
DEVELOP	27030	0.621	IMPERVIOUS	0.9	0.558	22	121	18	Grass	0.29	Shallow
B1						5	149	3	Grass	0.89	Shallow
						1	39	3	Impv	0.18	Shallow
TOTAL	110604	2.539		0.45		(Tc Calulation from Hydraflow)				18.12	(Total)
POST	13372	0.307	GRASS	0.3	0.092	Use minimum for grass)=				10	
DEVELOP	0	0.000	IMPERVIOUS	0.9	0.000						
B2											
TOTAL	13372	0.307		0.30							
POST	21303	0.489	GRASS	0.3	0.147	Use minimum for grass)=				10	
DEVELOP	2382	0.055	IMPERVIOUS	0.9	0.049						
C											
TOTAL	23685	0.544		0.36							

Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019



Legend

Hyd.	Origin	Description
1	Rational	Pre-Dev A
2	Rational	Pre-Dev B
3	Rational	Pre-Dev C
5	Rational	Post-Dev A
6	Rational	Post-Dev B1
7	Reservoir	UG Detention
8	Rational	Post-Dev B2
9	Combine	Post Dev B
10	Rational	Post-Dev C

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	------	-------	0.625	-------	-------	0.950	1.154	1.310	1.470	Pre-Dev A
2	Rational	------	-------	2.131	-------	-------	3.234	3.930	4.463	5.006	Pre-Dev B
3	Rational	------	-------	0.856	-------	-------	1.298	1.578	1.792	2.009	Pre-Dev C
5	Rational	------	-------	0.652	-------	-------	0.989	1.202	1.366	1.531	Post-Dev A
6	Rational	------	-------	2.880	-------	-------	4.375	5.314	6.034	6.771	Post-Dev B1
7	Reservoir	6	-------	1.259	-------	-------	2.288	2.918	3.380	4.350	UG Detention
8	Rational	------	-------	0.325	-------	-------	0.493	0.600	0.681	0.763	Post-Dev B2
9	Combine	7, 8	-------	1.259	-------	-------	2.288	2.918	3.380	4.350	Post Dev B
10	Rational	------	-------	0.692	-------	-------	1.049	1.275	1.448	1.622	Post-Dev C

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.625	1	18	998	------	------	------	Pre-Dev A
2	Rational	2.131	1	15	2,789	------	------	------	Pre-Dev B
3	Rational	0.856	1	12	913	------	------	------	Pre-Dev C
5	Rational	0.652	1	12	693	------	------	------	Post-Dev A
6	Rational	2.880	1	18	4,698	------	------	------	Post-Dev B1
7	Reservoir	1.259	1	38	2,522	6	305.65	3,301	UG Detention
8	Rational	0.325	1	10	293	------	------	------	Post-Dev B2
9	Combine	1.259	1	38	2,815	7, 8	------	------	Post Dev B
10	Rational	0.692	1	10	623	------	------	------	Post-Dev C

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.950	1	18	1,515	------	------	------	Pre-Dev A
2	Rational	3.234	1	15	4,233	------	------	------	Pre-Dev B
3	Rational	1.298	1	12	1,384	------	------	------	Pre-Dev C
5	Rational	0.989	1	12	1,051	------	------	------	Post-Dev A
6	Rational	4.375	1	18	7,136	------	------	------	Post-Dev B1
7	Reservoir	2.288	1	35	4,943	6	306.18	4,105	UG Detention
8	Rational	0.493	1	10	444	------	------	------	Post-Dev B2
9	Combine	2.288	1	35	5,387	7, 8	------	------	Post Dev B
10	Rational	1.049	1	10	944	------	------	------	Post-Dev C

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	1.154	1	18	1,841	------	------	------	Pre-Dev A
2	Rational	3.930	1	15	5,143	------	------	------	Pre-Dev B
3	Rational	1.578	1	12	1,683	------	------	------	Pre-Dev C
5	Rational	1.202	1	12	1,277	------	------	------	Post-Dev A
6	Rational	5.314	1	18	8,667	------	------	------	Post-Dev B1
7	Reservoir	2.918	1	34	6,464	6	306.65	4,644	UG Detention
8	Rational	0.600	1	10	540	------	------	------	Post-Dev B2
9	Combine	2.918	1	34	7,004	7, 8	------	------	Post Dev B
10	Rational	1.275	1	10	1,148	------	------	------	Post-Dev C

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	1.310	1	18	2,090	------	------	------	Pre-Dev A
2	Rational	4.463	1	15	5,841	------	------	------	Pre-Dev B
3	Rational	1.792	1	12	1,911	------	------	------	Pre-Dev C
5	Rational	1.366	1	12	1,450	------	------	------	Post-Dev A
6	Rational	6.034	1	18	9,843	------	------	------	Post-Dev B1
7	Reservoir	3.380	1	34	7,631	6	307.07	5,057	UG Detention
8	Rational	0.681	1	10	613	------	------	------	Post-Dev B2
9	Combine	3.380	1	34	8,244	7, 8	------	------	Post Dev B
10	Rational	1.448	1	10	1,303	------	------	------	Post-Dev C

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	1.470	1	18	2,345	------	------	------	Pre-Dev A
2	Rational	5.006	1	15	6,552	------	------	------	Pre-Dev B
3	Rational	2.009	1	12	2,142	------	------	------	Pre-Dev C
5	Rational	1.531	1	12	1,626	------	------	------	Post-Dev A
6	Rational	6.771	1	18	11,045	------	------	------	Post-Dev B1
7	Reservoir	4.350	1	31	8,825	6	307.38	5,355	UG Detention
8	Rational	0.763	1	10	687	------	------	------	Post-Dev B2
9	Combine	4.350	1	31	9,512	7, 8	------	------	Post Dev B
10	Rational	1.622	1	10	1,460	------	------	------	Post-Dev C

Hydraflow Table of Contents

2 - Year

10 - Year

25 - Year

50 - Year

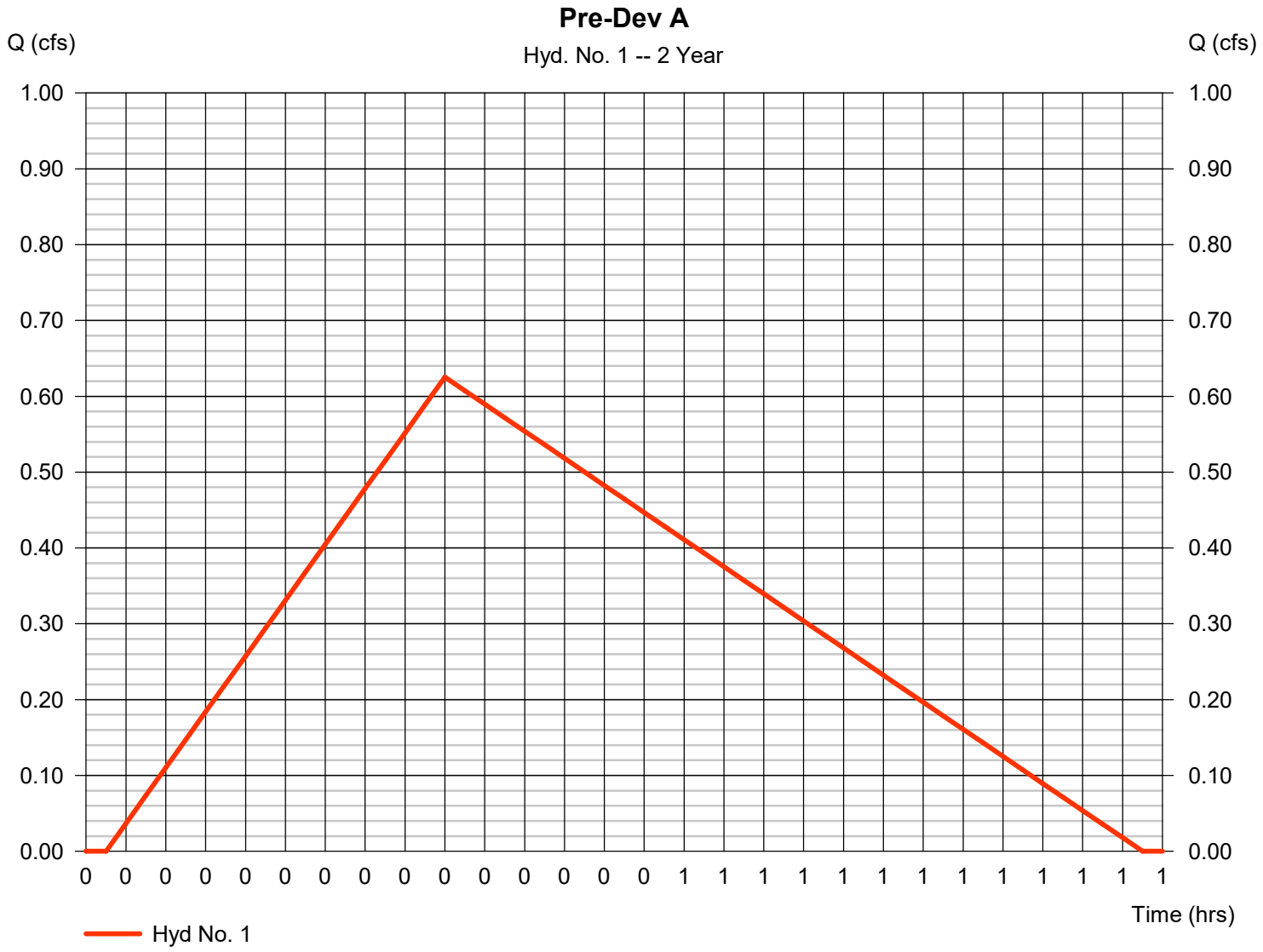
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Wednesday, 01 / 9 / 2019

Hyd. No. 1

Pre-Dev A

Hydrograph type	=	Rational	Peak discharge	=	0.625 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	998 cuft
Drainage area	=	0.816 ac	Runoff coeff.	=	0.3
Intensity	=	2.555 in/hr	Tc by TR55	=	17.73 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



TR55 Tc Worksheet

Hyd. No. 1

Pre-Dev A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 16.76**	**+**	**0.00**	**+**	**0.00**	**=**	**16.76**
Shallow Concentrated Flow							
Flow length (ft)	= 311.00		0.00		0.00		
Watercourse slope (%)	= 11.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.35		0.00		0.00		
Travel Time (min)	**= 0.97**	**+**	**0.00**	**+**	**0.00**	**=**	**0.97**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 17.73 min

Hydrograph Report

Hyd. No. 2

Pre-Dev B

Hydrograph type	=	Rational	Peak discharge	=	2.131 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.25 hrs
Time interval	=	1 min	Hyd. volume	=	2,789 cuft
Drainage area	=	2.320 ac	Runoff coeff.	=	0.32*
Intensity	=	2.870 in/hr	Tc by TR55	=	14.54 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(1.790 x 0.30) + (0.145 x 0.90) + (0.381 x 0.20)] / 2.320

TR55 Tc Worksheet

Hyd. No. 2

Pre-Dev B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 5.00		0.00		0.00		
Travel Time (min)	**= 13.66**	**+**	**0.00**	**+**	**0.00**	**=**	**13.66**
Shallow Concentrated Flow							
Flow length (ft)	= 296.00		0.00		0.00		
Watercourse slope (%)	= 12.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.59		0.00		0.00		
Travel Time (min)	**= 0.88**	**+**	**0.00**	**+**	**0.00**	**=**	**0.88**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 14.54 min

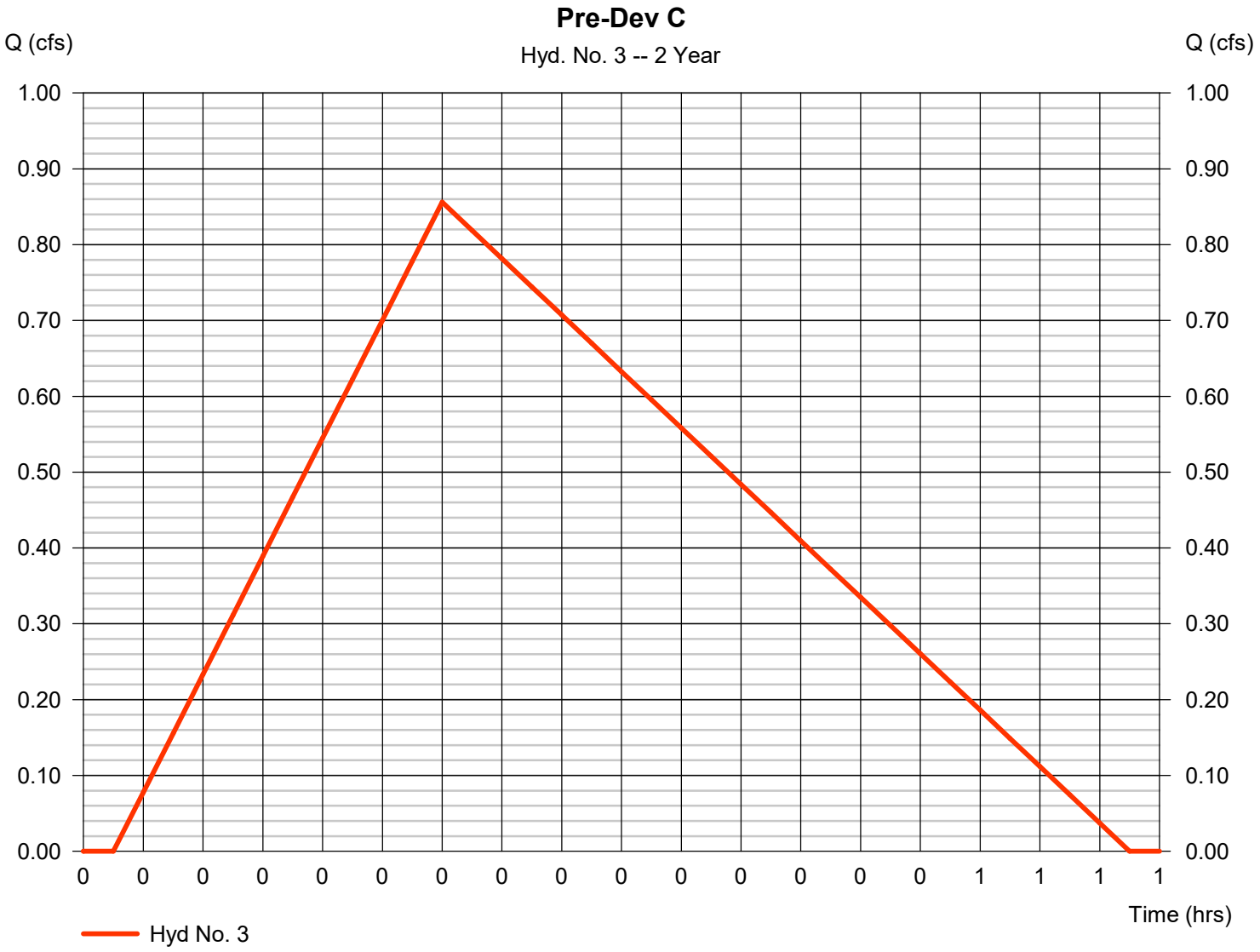
Hydrograph Report

Hyd. No. 3

Pre-Dev C

Hydrograph type	=	Rational	Peak discharge	=	0.856 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	913 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.32*
Intensity	=	3.223 in/hr	Tc by TR55	=	11.85 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(0.256 x 0.30) + (0.108 x 0.90) + (0.461 x 0.20)] / 0.830



TR55 Tc Worksheet

Hyd. No. 3

Pre-Dev C

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 9.00		0.00		0.00		
Travel Time (min)	**= 10.80**	**+**	**0.00**	**+**	**0.00**	**=**	**10.80**
Shallow Concentrated Flow							
Flow length (ft)	= 305.00		0.00		0.00		
Watercourse slope (%)	= 9.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.84		0.00		0.00		
Travel Time (min)	**= 1.05**	**+**	**0.00**	**+**	**0.00**	**=**	**1.05**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

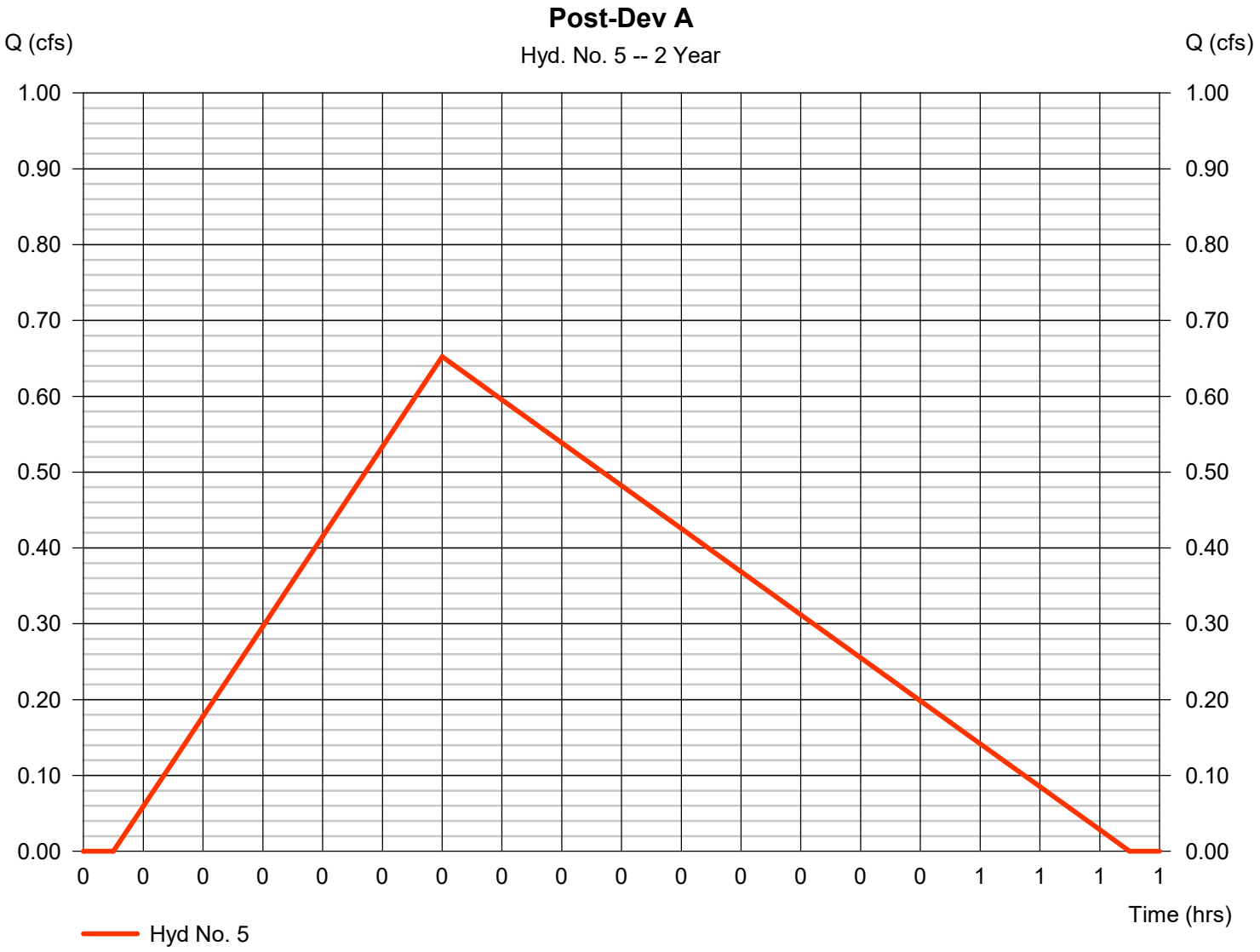
Total Travel Time, Tc ..... 11.85 min

Hydrograph Report

Hyd. No. 5

Post-Dev A

Hydrograph type	=	Rational	Peak discharge	=	0.652 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	693 cuft
Drainage area	=	0.577 ac	Runoff coeff.	=	0.35
Intensity	=	3.230 in/hr	Tc by TR55	=	11.80 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



TR55 Tc Worksheet

Hyd. No. 5

Post-Dev A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 9.00		0.00		0.00		
Travel Time (min)	**= 10.80**	**+**	**0.00**	**+**	**0.00**	**=**	**10.80**
Shallow Concentrated Flow							
Flow length (ft)	= 189.00		76.00		0.00		
Watercourse slope (%)	= 8.00		4.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.56		4.07		0.00		
Travel Time (min)	**= 0.69**	**+**	**0.31**	**+**	**0.00**	**=**	**1.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

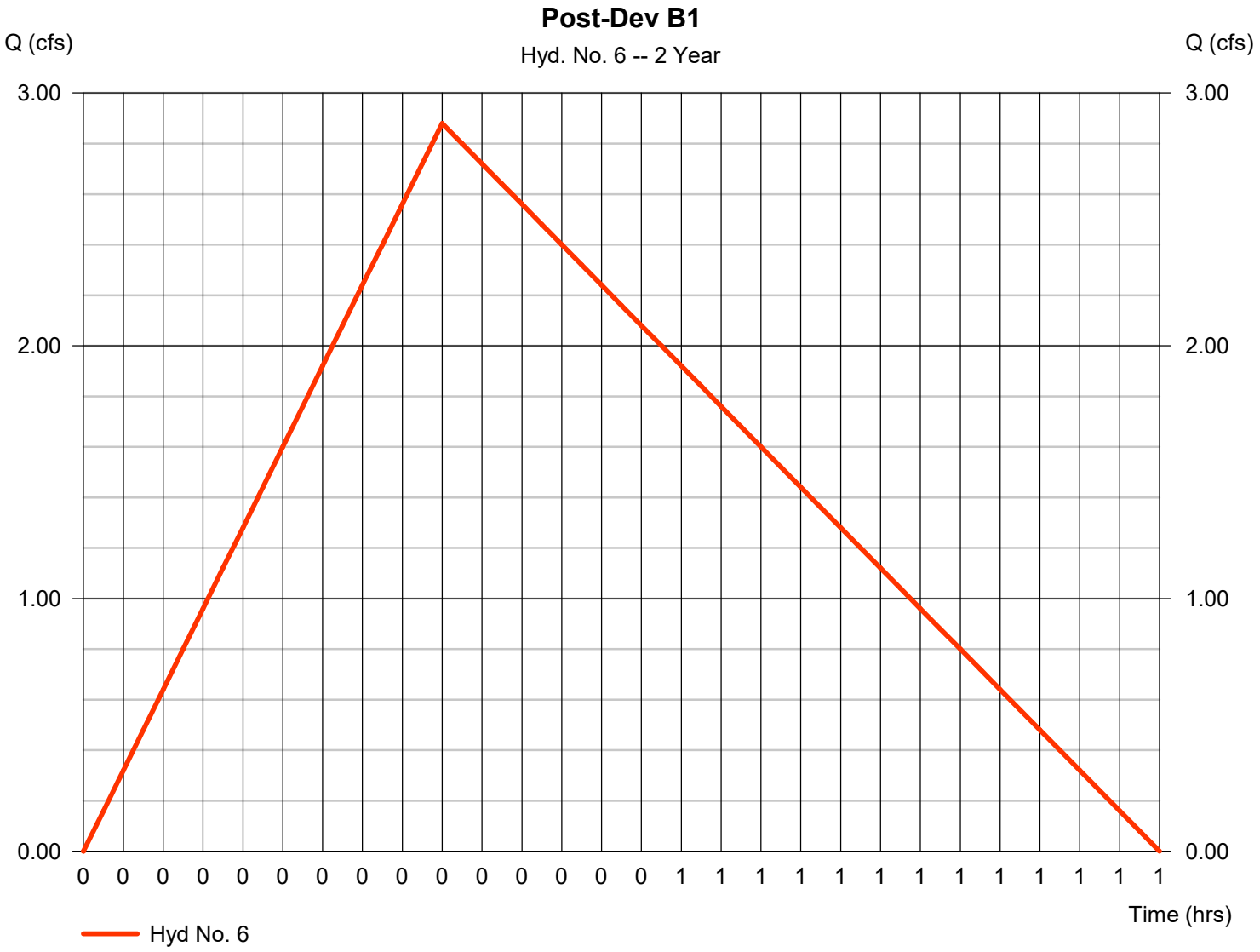
Total Travel Time, Tc ..... 11.80 min

Hydrograph Report

Hyd. No. 6

Post-Dev B1

Hydrograph type	= Rational	Peak discharge	= 2.880 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.30 hrs
Time interval	= 1 min	Hyd. volume	= 4,698 cuft
Drainage area	= 2.539 ac	Runoff coeff.	= 0.45
Intensity	= 2.521 in/hr	Tc by TR55	= 18.12 min
IDF Curve	= West Hartford_IDF.IDF	Asc/Rec limb fact	= 1/2



TR55 Tc Worksheet

Hyd. No. 6

Post-Dev B1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 16.76**	**+**	**0.00**	**+**	**0.00**	**=**	**16.76**
Shallow Concentrated Flow							
Flow length (ft)	= 121.00		149.00		39.00		
Watercourse slope (%)	= 18.00		3.00		3.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=6.85		2.79		3.52		
Travel Time (min)	**= 0.29**	**+**	**0.89**	**+**	**0.18**	**=**	**1.37**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 18.12 min

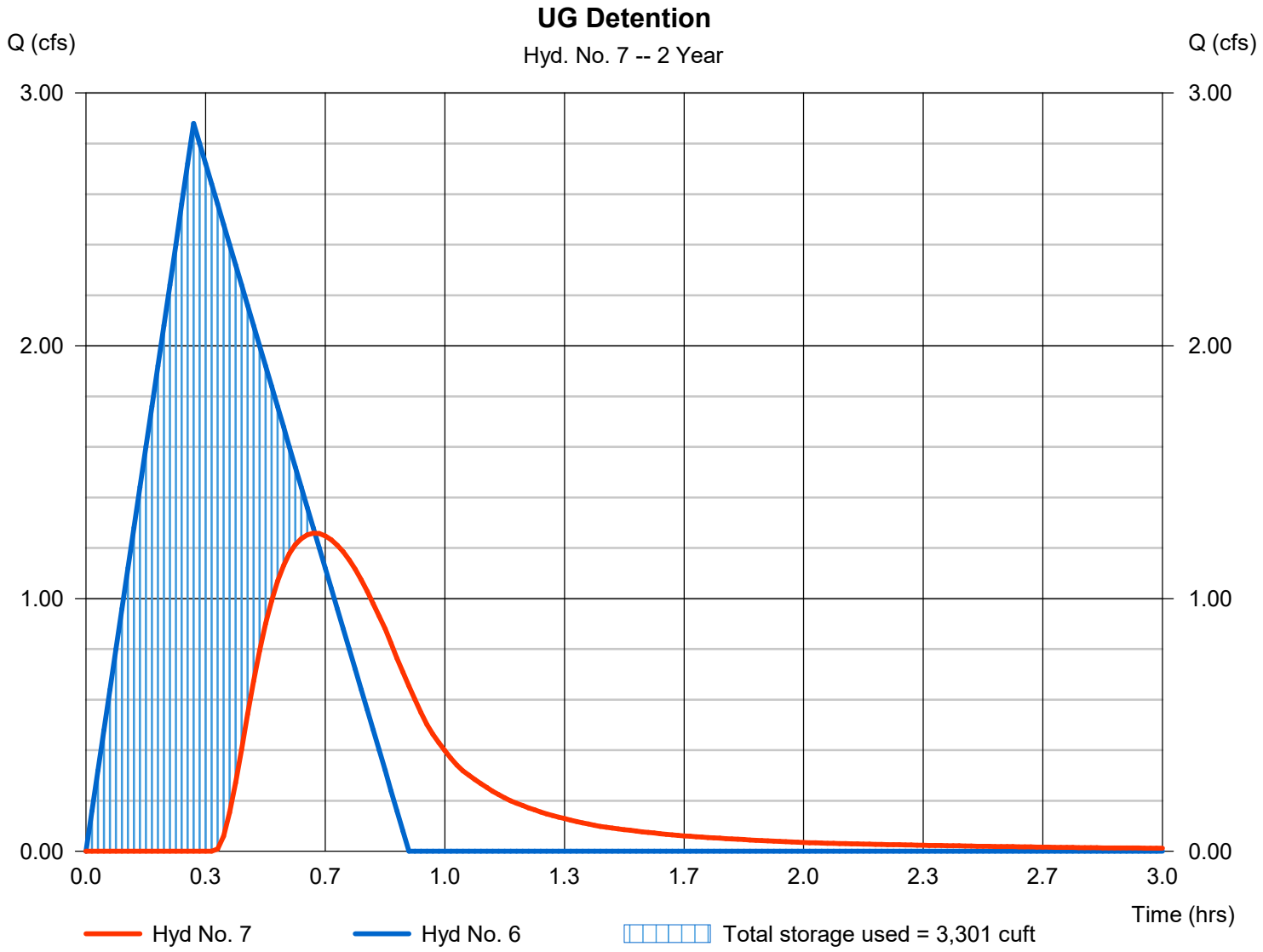
Hydrograph Report

Hyd. No. 7

UG Detention

Hydrograph type	=	Reservoir	Peak discharge	=	1.259 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.63 hrs
Time interval	=	1 min	Hyd. volume	=	2,522 cuft
Inflow hyd. No.	=	6 - Post-Dev B1	Max. Elevation	=	305.65 ft
Reservoir name	=	UG Detention	Max. Storage	=	3,301 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - UG Detention

Pond Data

UG Chambers -Invert elev. = 303.90 ft, Rise x Span = 2.50 x 4.30 ft, Barrel Len = 387.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 303.90 ft, Width = 6.30 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	303.90	n/a	0	0
0.35	304.25	n/a	690	690
0.70	304.60	n/a	683	1,373
1.05	304.95	n/a	668	2,041
1.40	305.30	n/a	646	2,687
1.75	305.65	n/a	612	3,299
2.10	306.00	n/a	563	3,862
2.45	306.35	n/a	482	4,344
2.80	306.70	n/a	348	4,692
3.15	307.05	n/a	341	5,033
3.50	307.40	n/a	341	5,375

Culvert / Orifice Structures

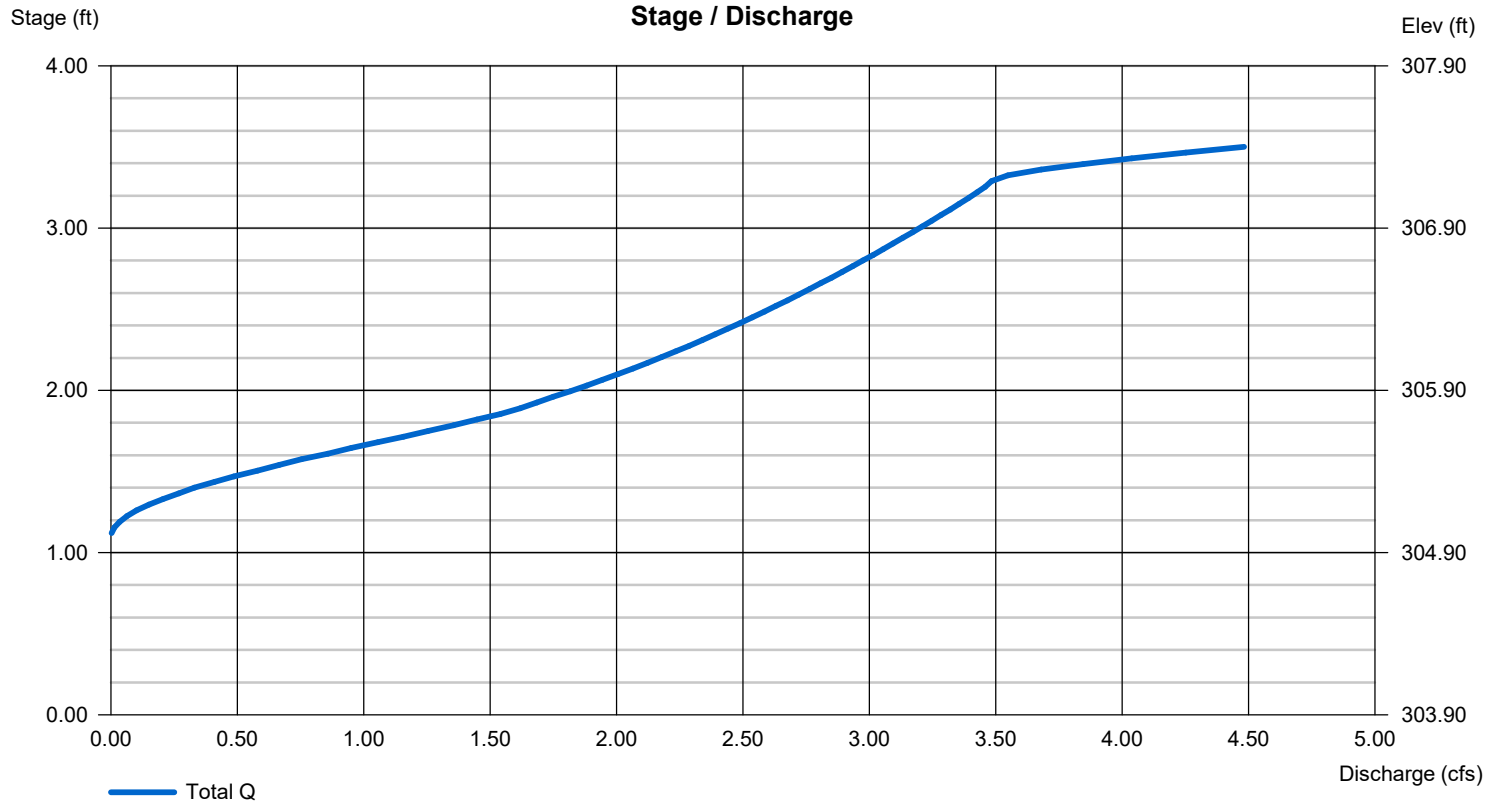
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	10.00	0.00	0.00
Span (in)	= 12.00	10.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 303.90	305.00	0.00	0.00
Length (ft)	= 16.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 307.20	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Report

Hyd. No. 8

Post-Dev B2

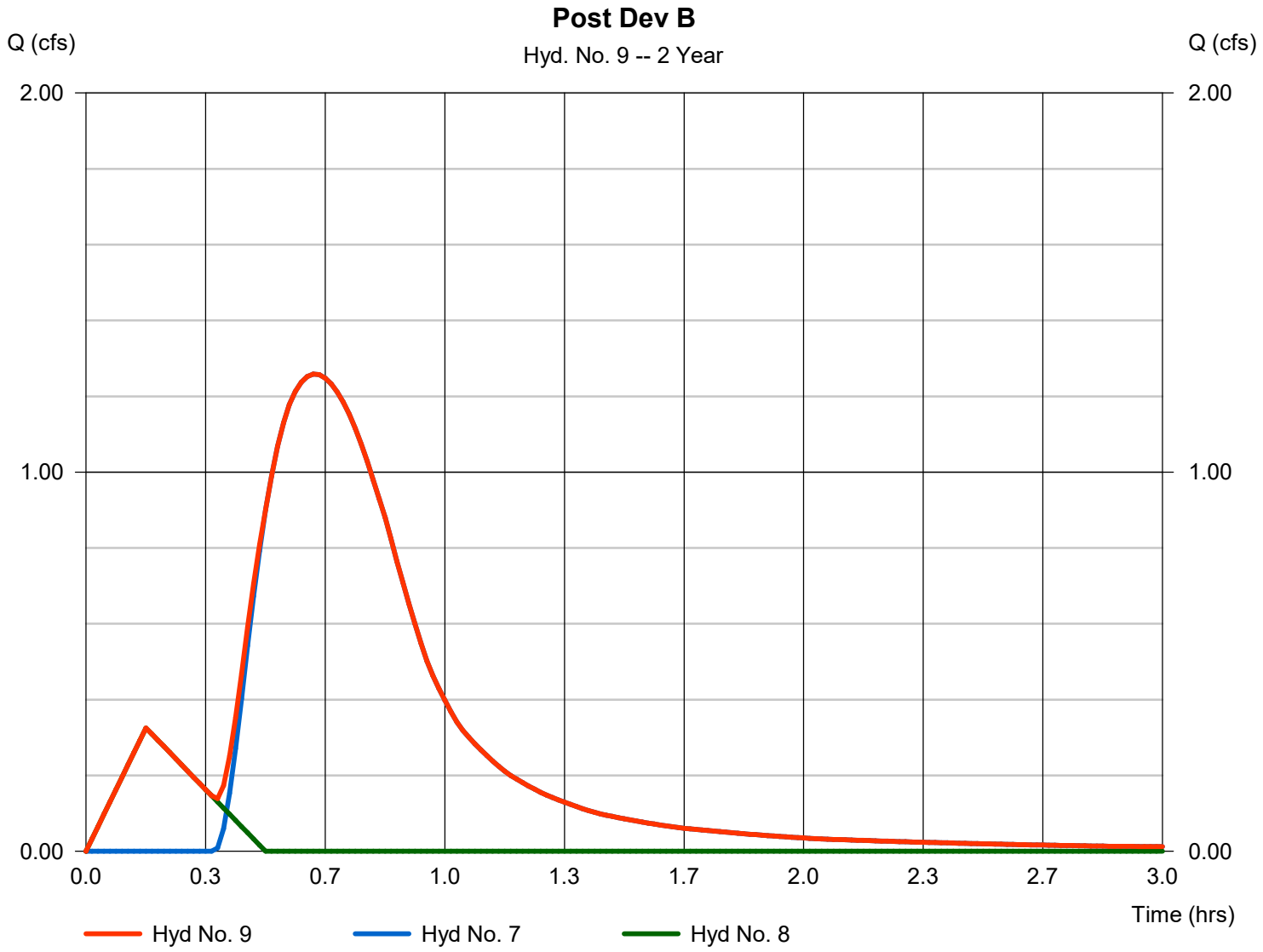
Hydrograph type	=	Rational	Peak discharge	=	0.325 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	293 cuft
Drainage area	=	0.307 ac	Runoff coeff.	=	0.3
Intensity	=	3.532 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

Hydrograph Report

Hyd. No. 9

Post Dev B

Hydrograph type	=	Combine	Peak discharge	=	1.259 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.63 hrs
Time interval	=	1 min	Hyd. volume	=	2,815 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	0.307 ac



Hydrograph Report

Hyd. No. 10

Post-Dev C

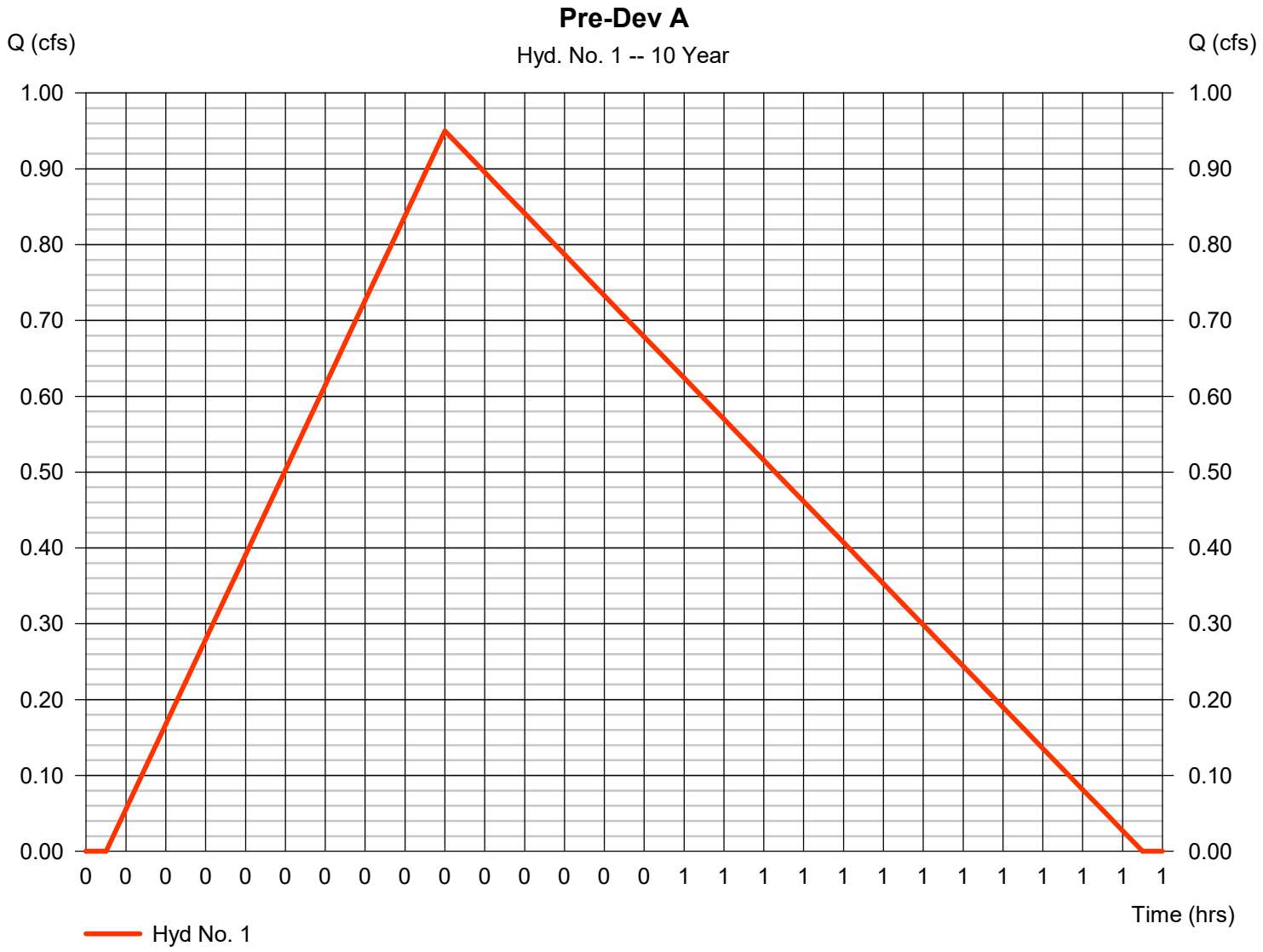
Hydrograph type	=	Rational	Peak discharge	=	0.692 cfs
Storm frequency	=	2 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	623 cuft
Drainage area	=	0.544 ac	Runoff coeff.	=	0.36
Intensity	=	3.532 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

Hydrograph Report

Hyd. No. 1

Pre-Dev A

Hydrograph type	=	Rational	Peak discharge	=	0.950 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	1,515 cuft
Drainage area	=	0.816 ac	Runoff coeff.	=	0.3
Intensity	=	3.880 in/hr	Tc by TR55	=	17.73 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



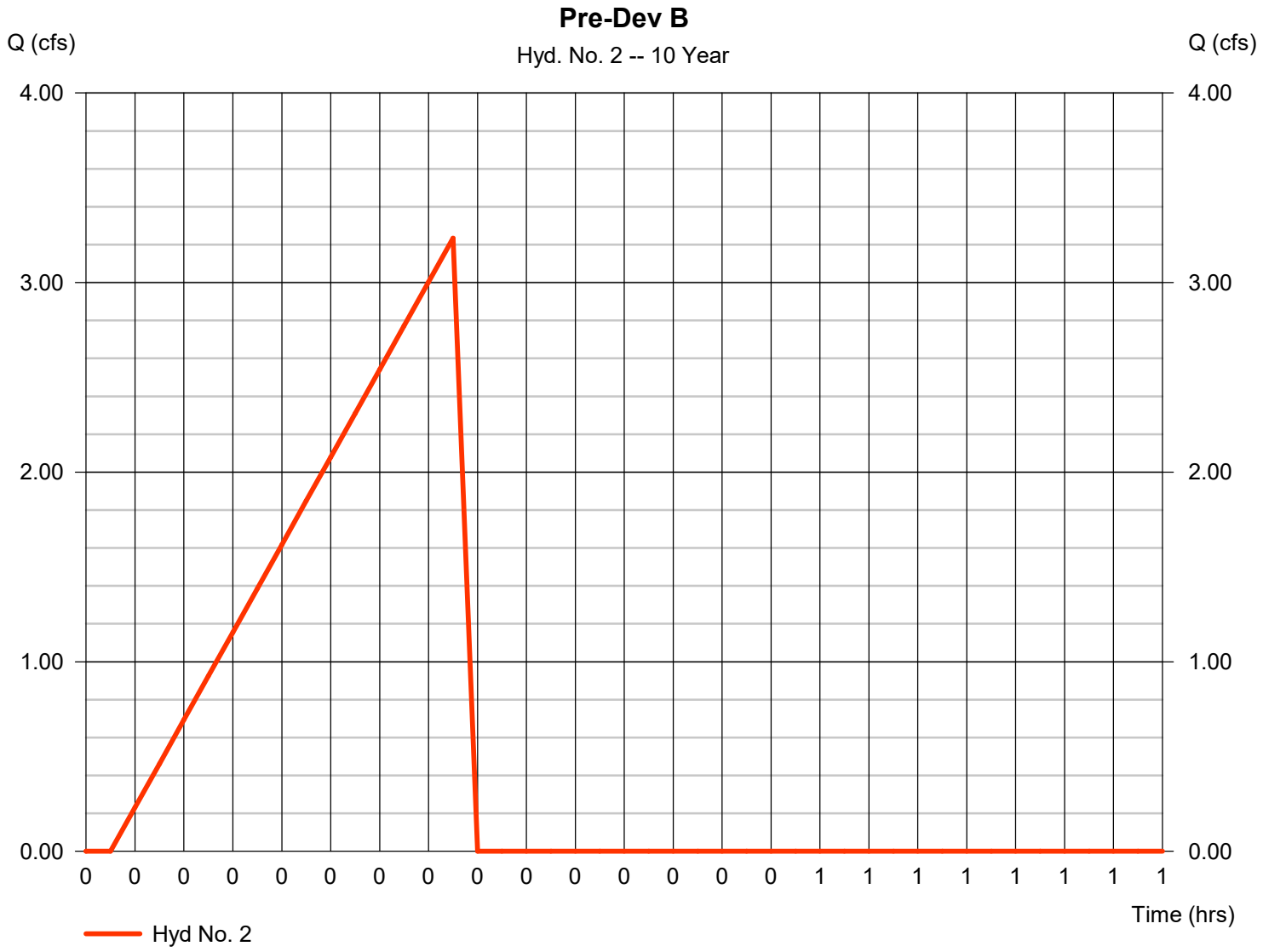
Hydrograph Report

Hyd. No. 2

Pre-Dev B

Hydrograph type	=	Rational	Peak discharge	=	3.234 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.25 hrs
Time interval	=	1 min	Hyd. volume	=	4,233 cuft
Drainage area	=	2.320 ac	Runoff coeff.	=	0.32*
Intensity	=	4.357 in/hr	Tc by TR55	=	14.54 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(1.790 x 0.30) + (0.145 x 0.90) + (0.381 x 0.20)] / 2.320



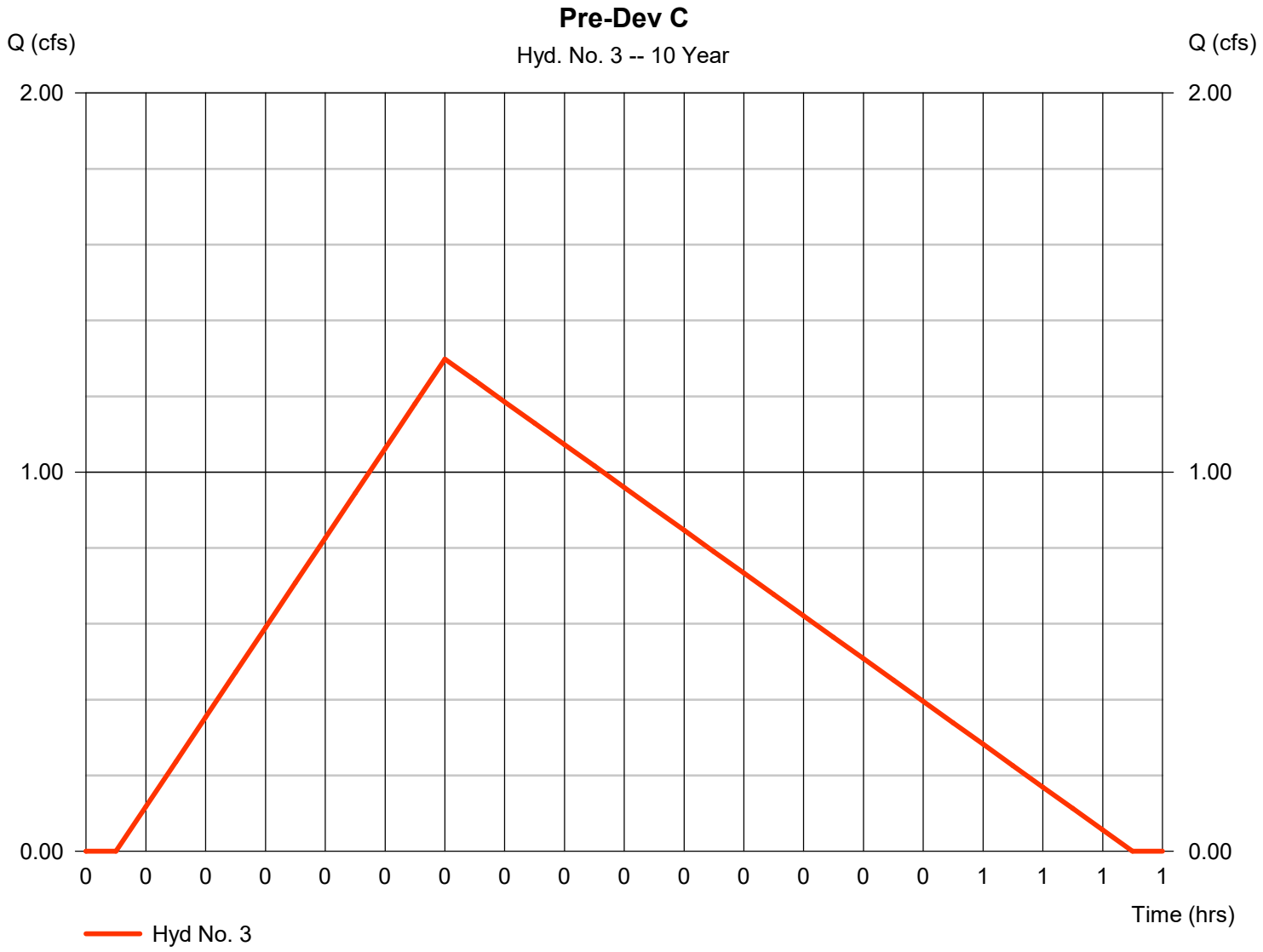
Hydrograph Report

Hyd. No. 3

Pre-Dev C

Hydrograph type	=	Rational	Peak discharge	=	1.298 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	1,384 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.32*
Intensity	=	4.888 in/hr	Tc by TR55	=	11.85 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(0.256 x 0.30) + (0.108 x 0.90) + (0.461 x 0.20)] / 0.830

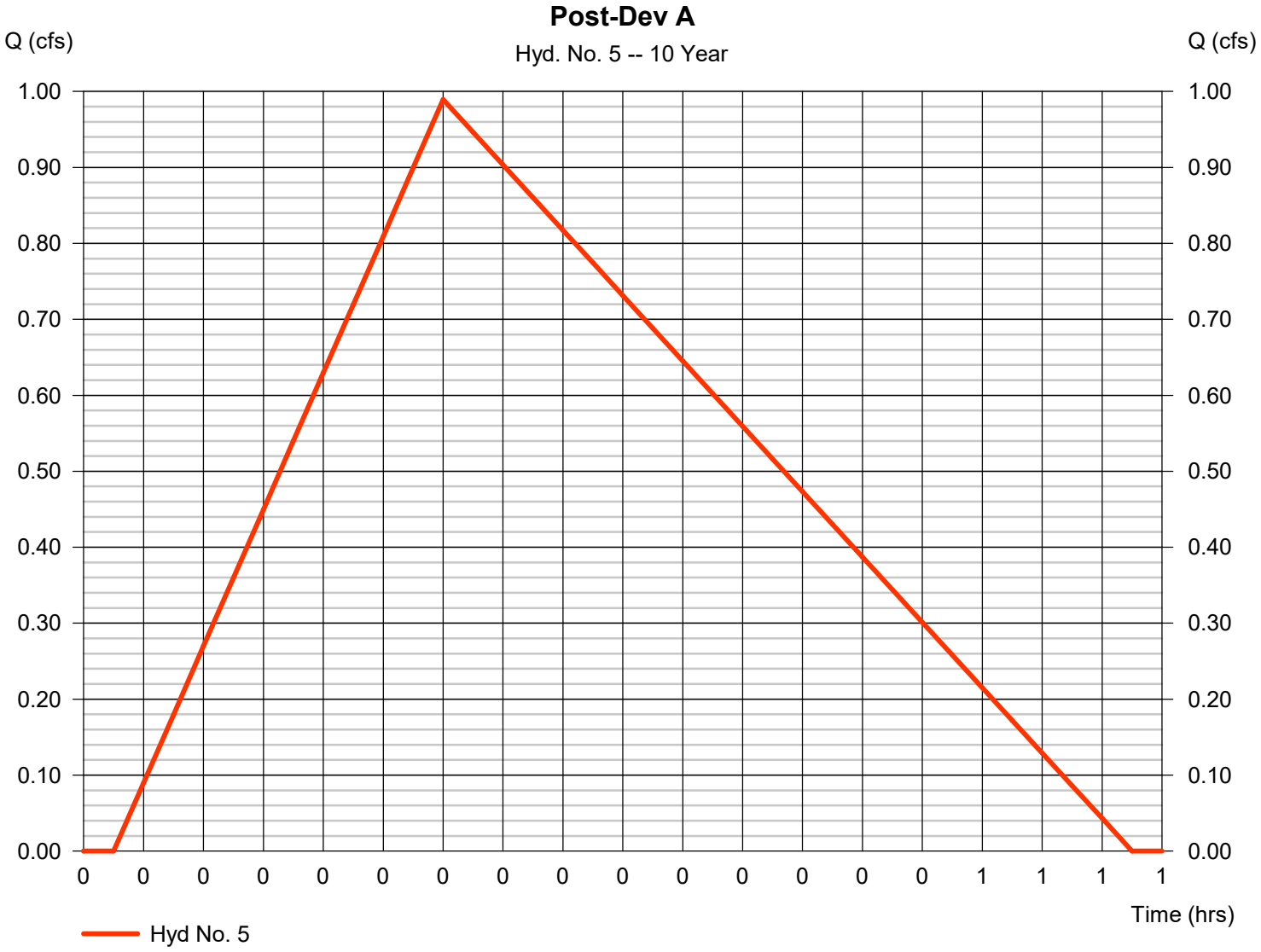


Hydrograph Report

Hyd. No. 5

Post-Dev A

Hydrograph type	=	Rational	Peak discharge	=	0.989 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	1,051 cuft
Drainage area	=	0.577 ac	Runoff coeff.	=	0.35
Intensity	=	4.899 in/hr	Tc by TR55	=	11.80 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

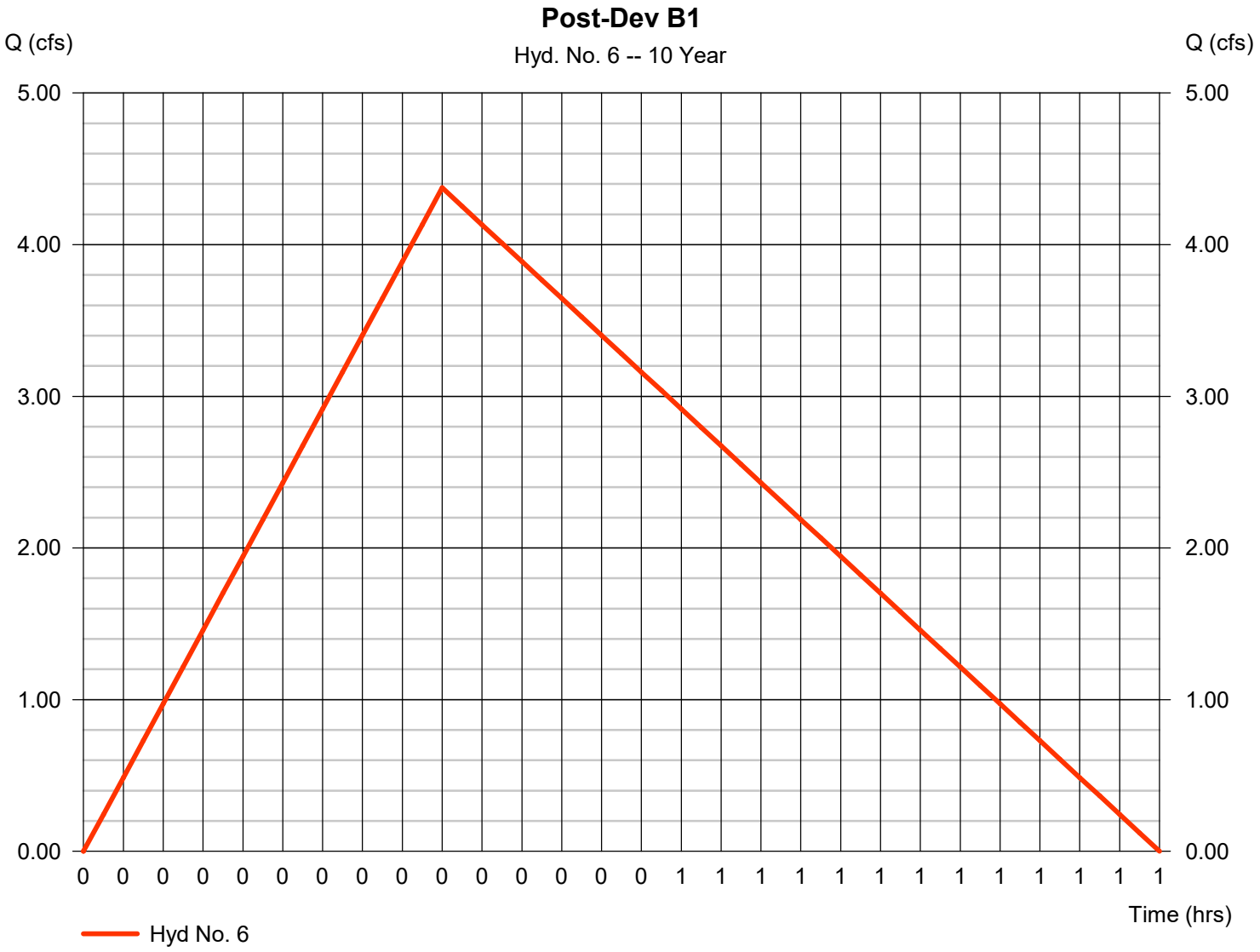


Hydrograph Report

Hyd. No. 6

Post-Dev B1

Hydrograph type	= Rational	Peak discharge	= 4.375 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.30 hrs
Time interval	= 1 min	Hyd. volume	= 7,136 cuft
Drainage area	= 2.539 ac	Runoff coeff.	= 0.45
Intensity	= 3.829 in/hr	Tc by TR55	= 18.12 min
IDF Curve	= West Hartford_IDF.IDF	Asc/Rec limb fact	= 1/2



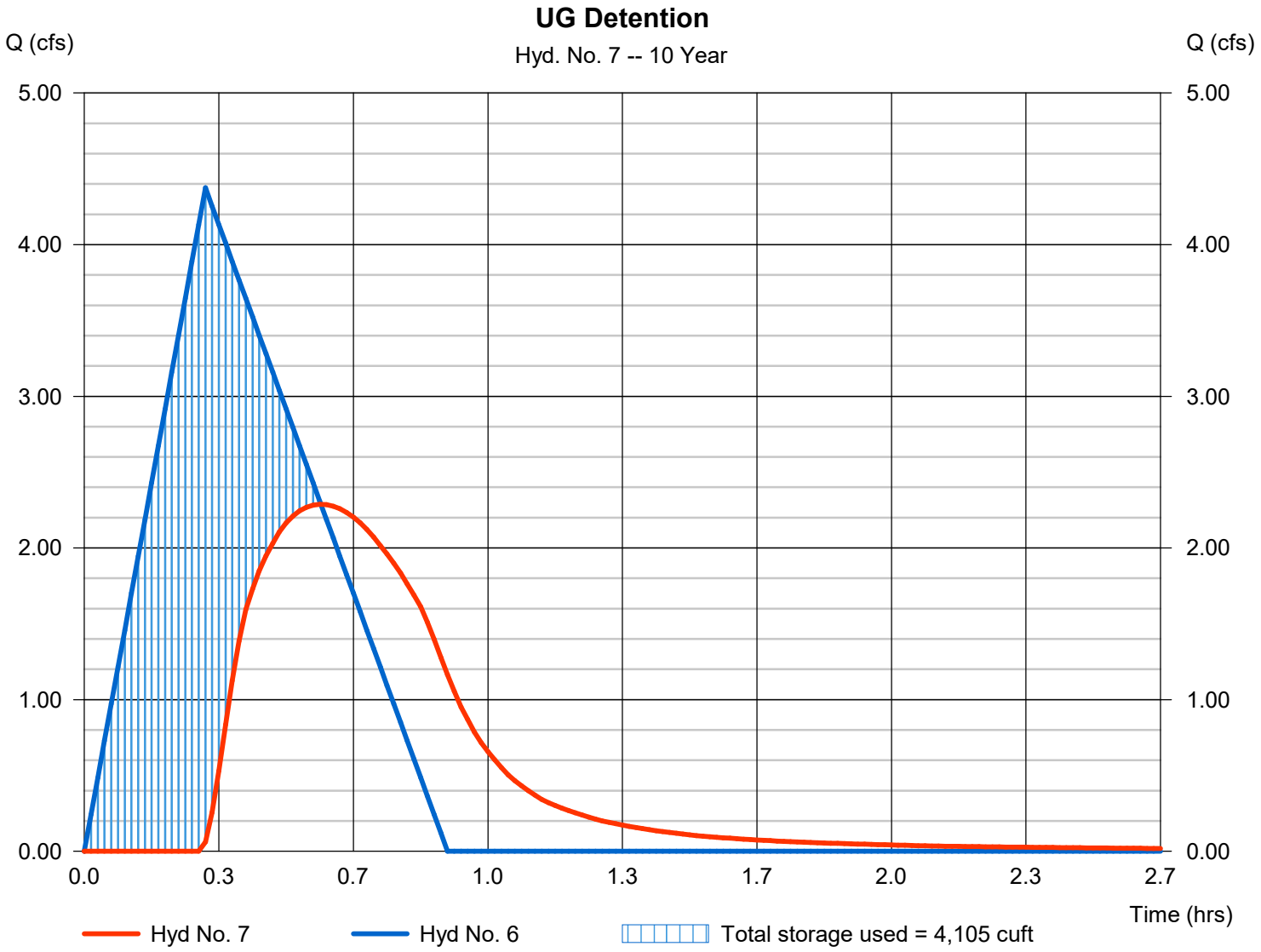
Hydrograph Report

Hyd. No. 7

UG Detention

Hydrograph type	=	Reservoir	Peak discharge	=	2.288 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.58 hrs
Time interval	=	1 min	Hyd. volume	=	4,943 cuft
Inflow hyd. No.	=	6 - Post-Dev B1	Max. Elevation	=	306.18 ft
Reservoir name	=	UG Detention	Max. Storage	=	4,105 cuft

Storage Indication method used.



Hydrograph Report

Hyd. No. 8

Post-Dev B2

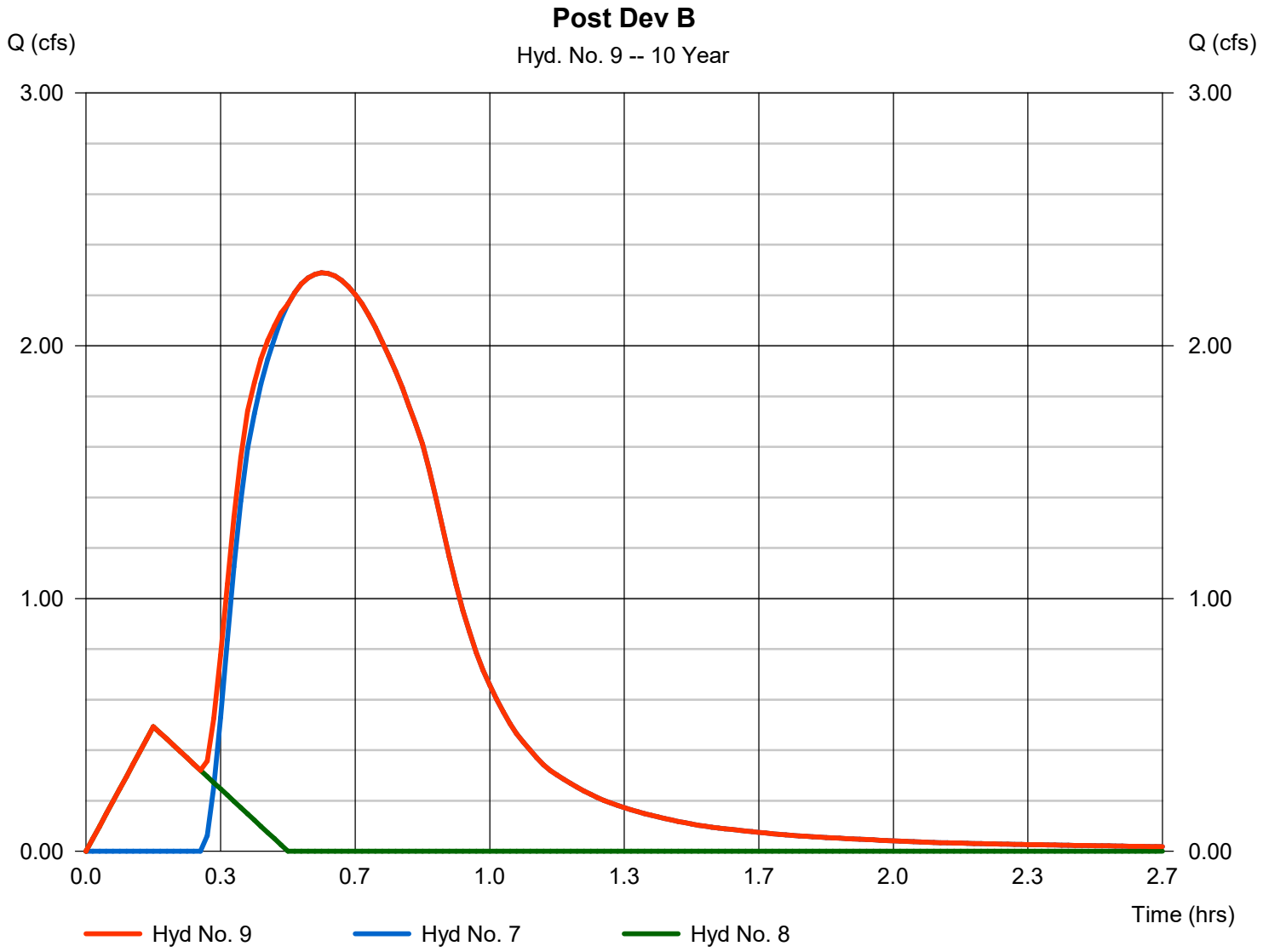
Hydrograph type	=	Rational	Peak discharge	=	0.493 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	444 cuft
Drainage area	=	0.307 ac	Runoff coeff.	=	0.3
Intensity	=	5.355 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

Hydrograph Report

Hyd. No. 9

Post Dev B

Hydrograph type	= Combine	Peak discharge	= 2.288 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.58 hrs
Time interval	= 1 min	Hyd. volume	= 5,387 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 0.307 ac

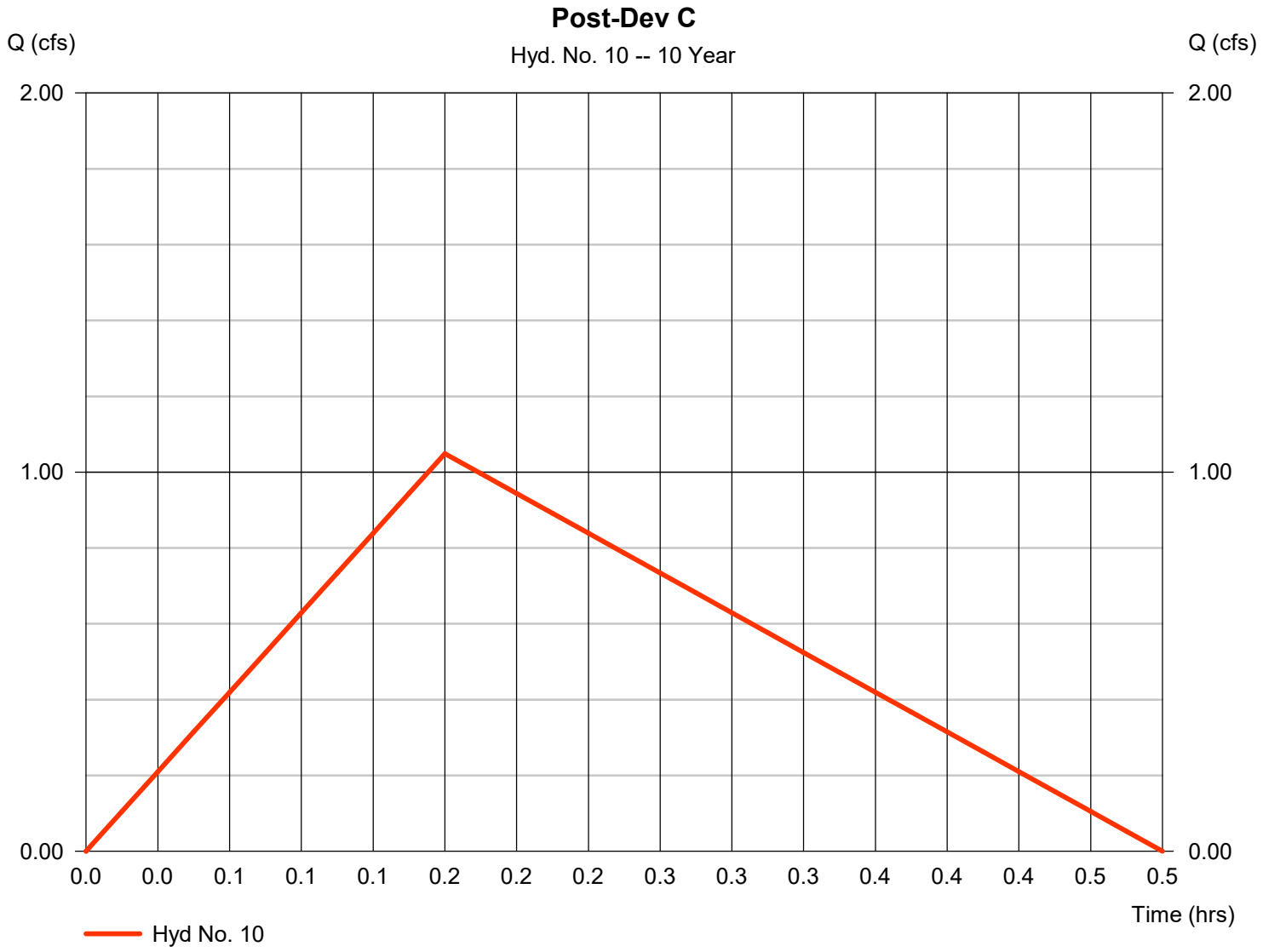


Hydrograph Report

Hyd. No. 10

Post-Dev C

Hydrograph type	=	Rational	Peak discharge	=	1.049 cfs
Storm frequency	=	10 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	944 cuft
Drainage area	=	0.544 ac	Runoff coeff.	=	0.36
Intensity	=	5.355 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

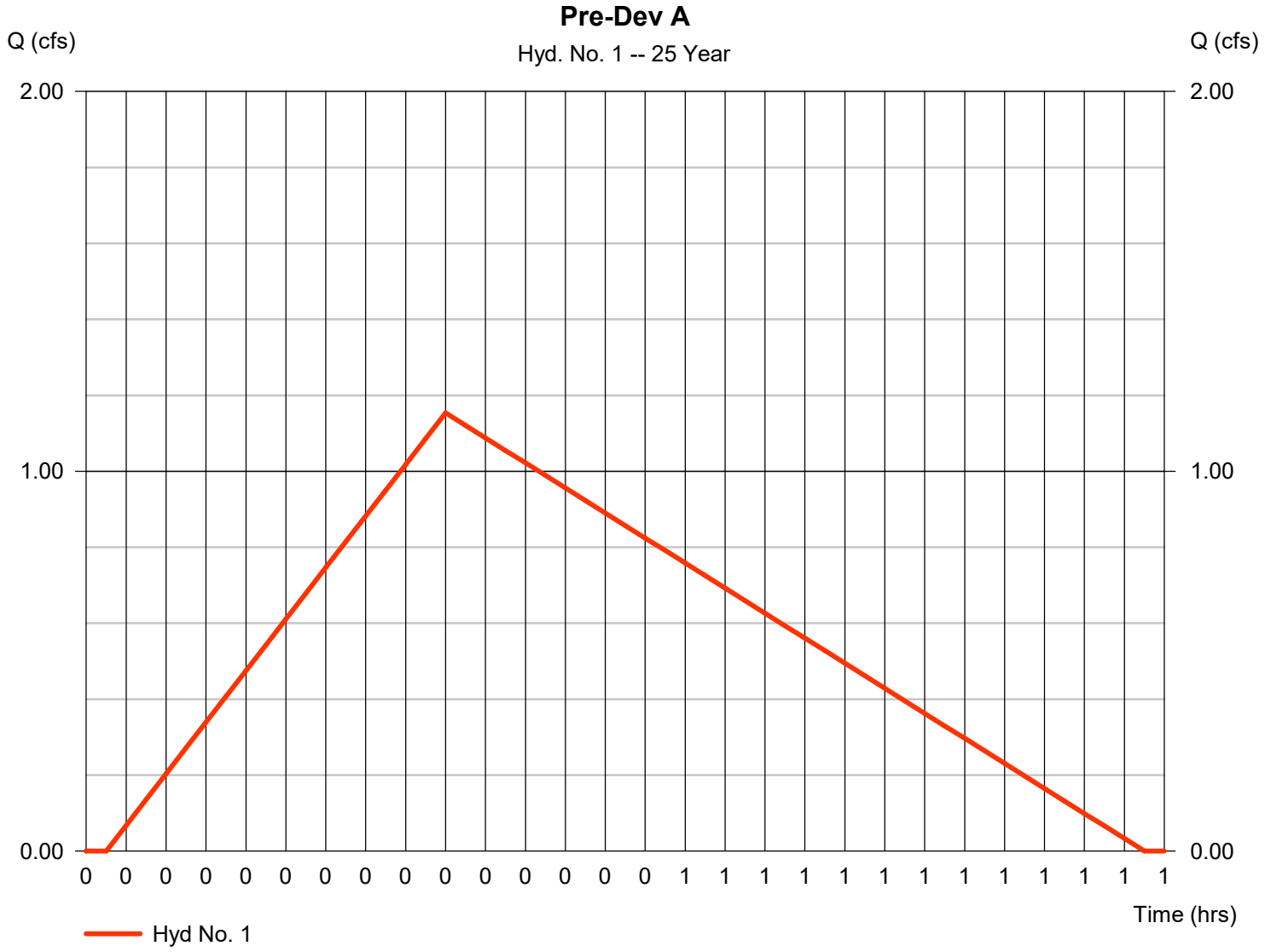


Hydrograph Report

Hyd. No. 1

Pre-Dev A

Hydrograph type	=	Rational	Peak discharge	=	1.154 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	1,841 cuft
Drainage area	=	0.816 ac	Runoff coeff.	=	0.3
Intensity	=	4.713 in/hr	Tc by TR55	=	17.73 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



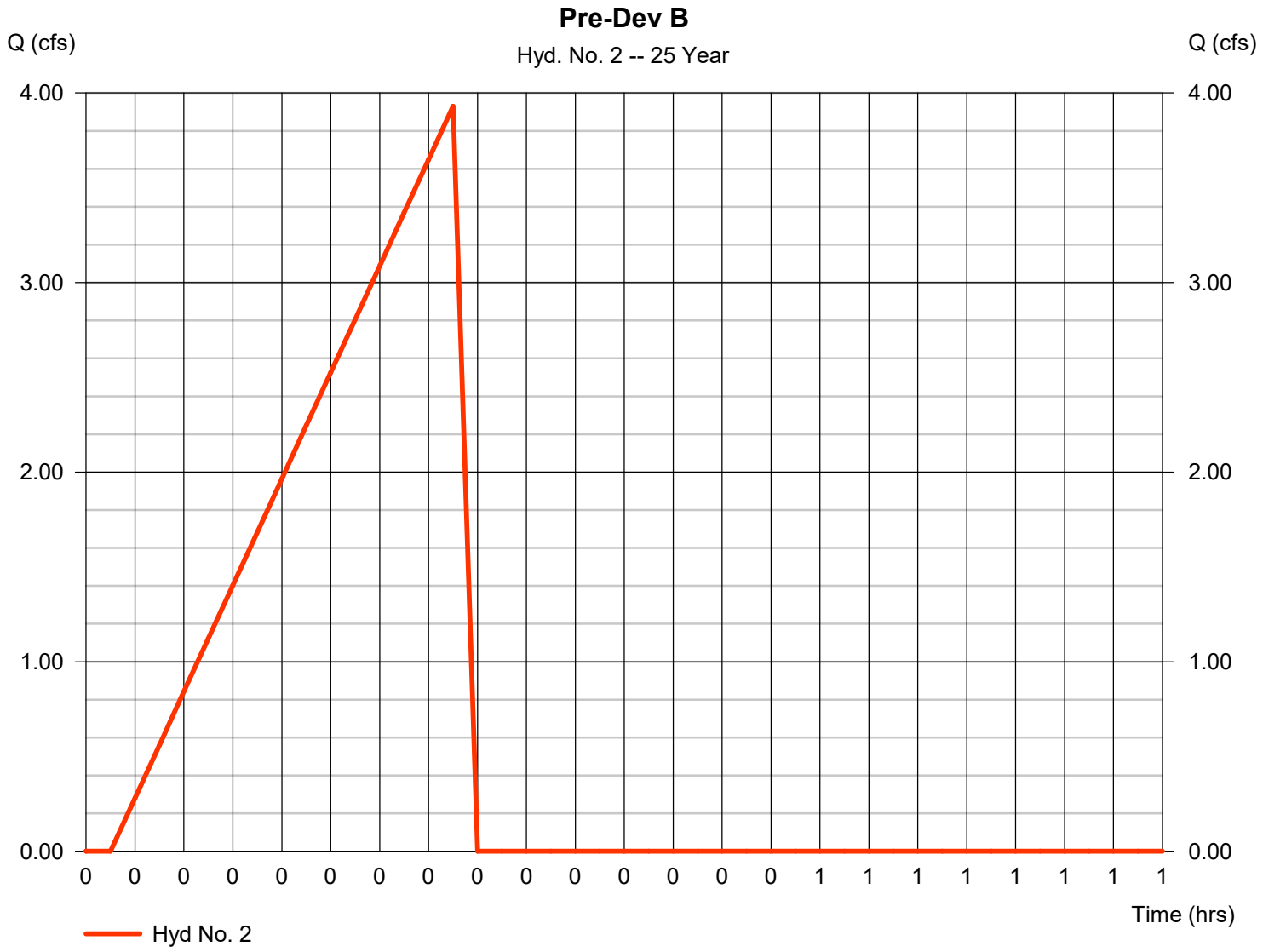
Hydrograph Report

Hyd. No. 2

Pre-Dev B

Hydrograph type	=	Rational	Peak discharge	=	3.930 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.25 hrs
Time interval	=	1 min	Hyd. volume	=	5,143 cuft
Drainage area	=	2.320 ac	Runoff coeff.	=	0.32*
Intensity	=	5.293 in/hr	Tc by TR55	=	14.54 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(1.790 x 0.30) + (0.145 x 0.90) + (0.381 x 0.20)] / 2.320



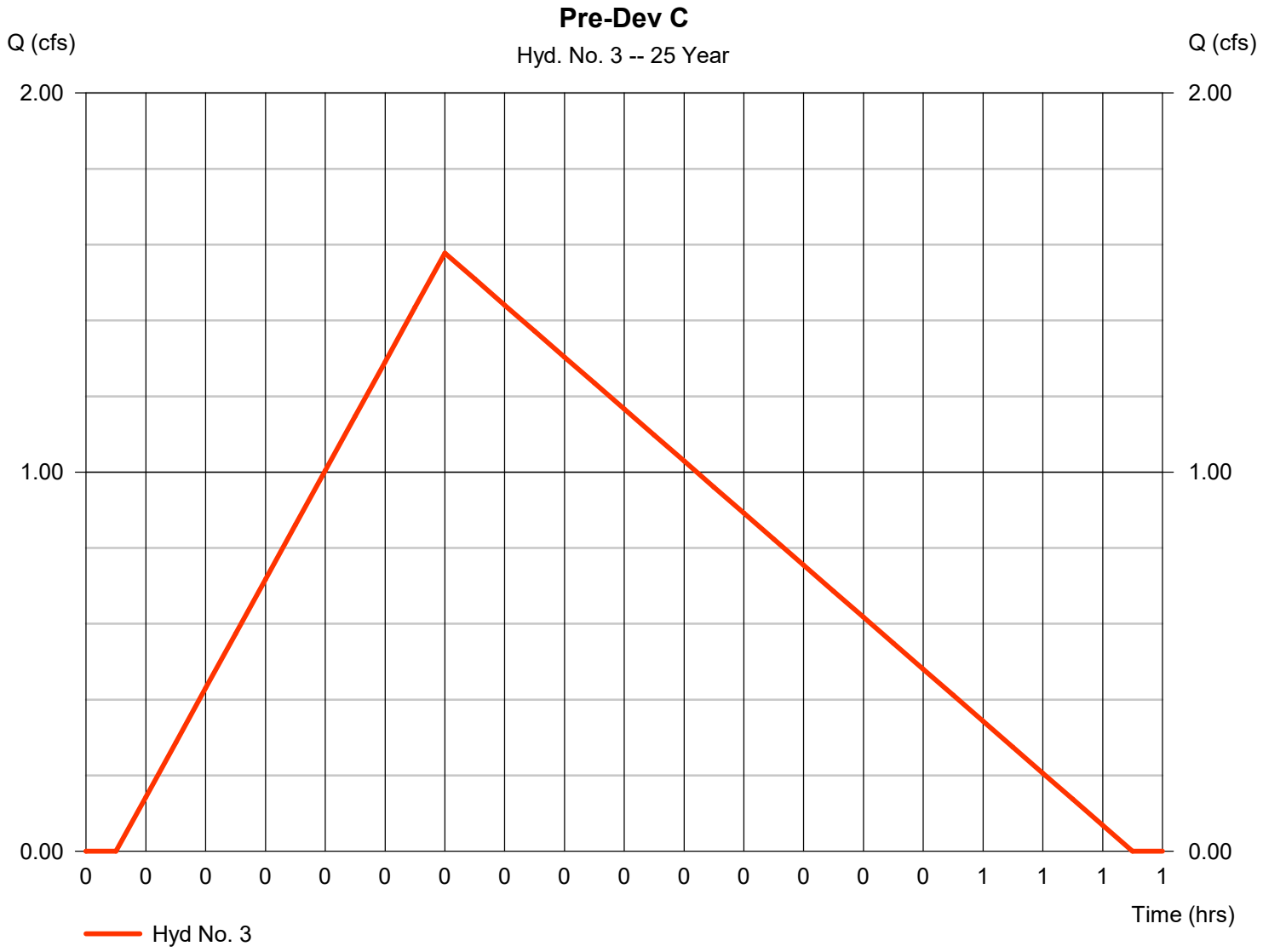
Hydrograph Report

Hyd. No. 3

Pre-Dev C

Hydrograph type	= Rational	Peak discharge	= 1.578 cfs
Storm frequency	= 25 yrs	Time to peak	= 0.20 hrs
Time interval	= 1 min	Hyd. volume	= 1,683 cuft
Drainage area	= 0.830 ac	Runoff coeff.	= 0.32*
Intensity	= 5.941 in/hr	Tc by TR55	= 11.85 min
IDF Curve	= West Hartford_IDF.IDF	Asc/Rec limb fact	= 1/2

* Composite (Area/C) = [(0.256 x 0.30) + (0.108 x 0.90) + (0.461 x 0.20)] / 0.830

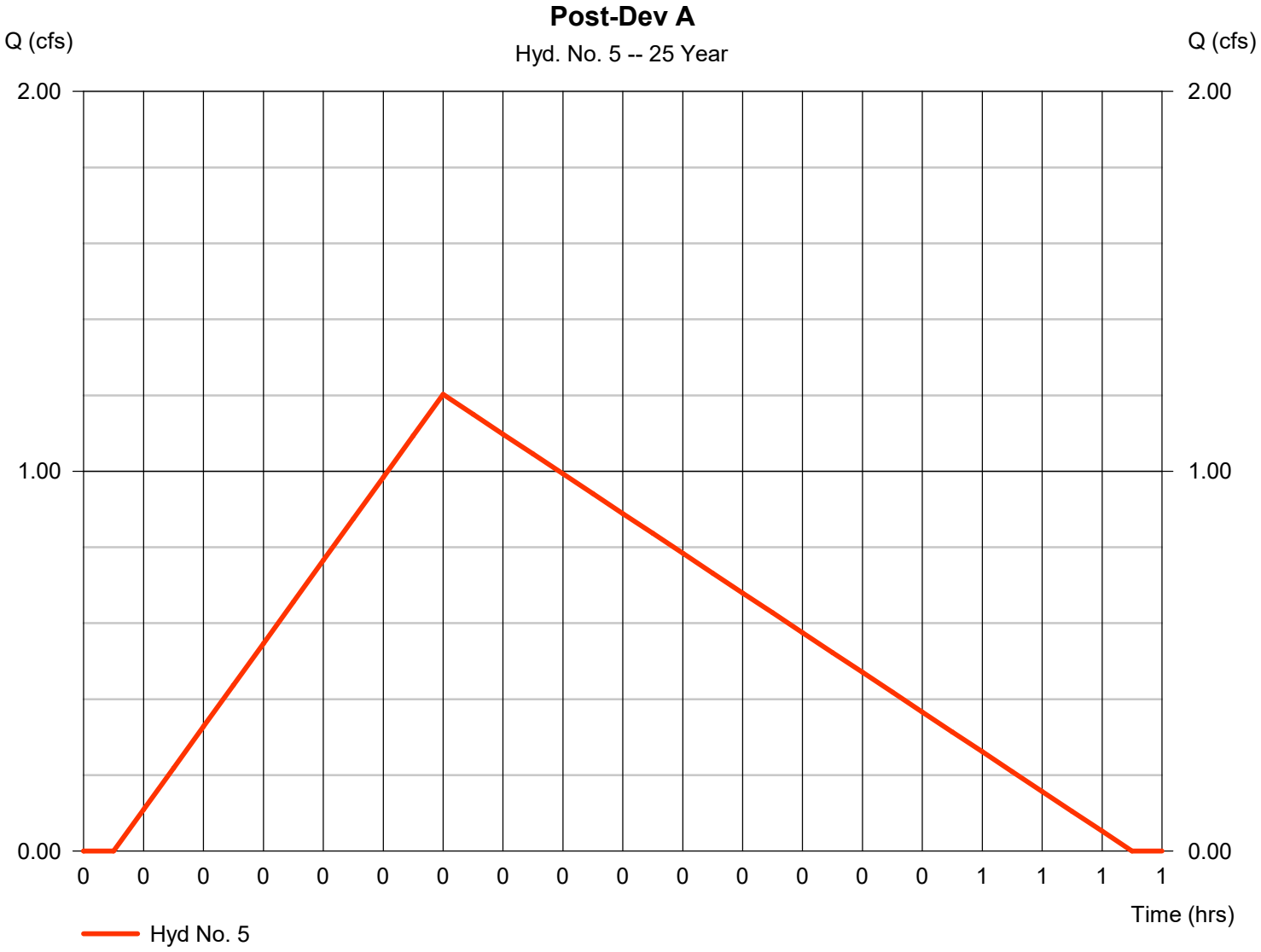


Hydrograph Report

Hyd. No. 5

Post-Dev A

Hydrograph type	=	Rational	Peak discharge	=	1.202 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	1,277 cuft
Drainage area	=	0.577 ac	Runoff coeff.	=	0.35
Intensity	=	5.954 in/hr	Tc by TR55	=	11.80 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

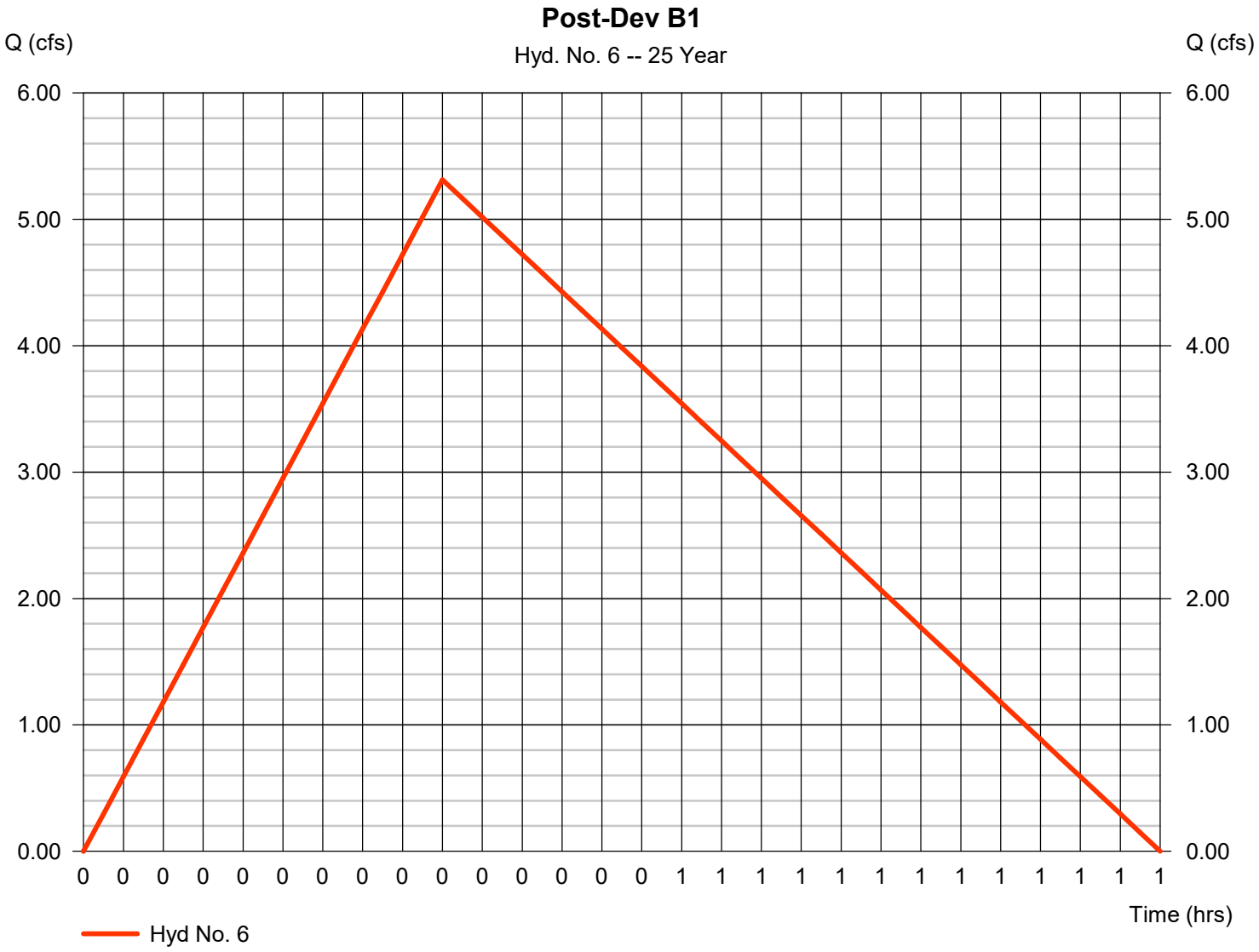


Hydrograph Report

Hyd. No. 6

Post-Dev B1

Hydrograph type	=	Rational	Peak discharge	=	5.314 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	8,667 cuft
Drainage area	=	2.539 ac	Runoff coeff.	=	0.45
Intensity	=	4.651 in/hr	Tc by TR55	=	18.12 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



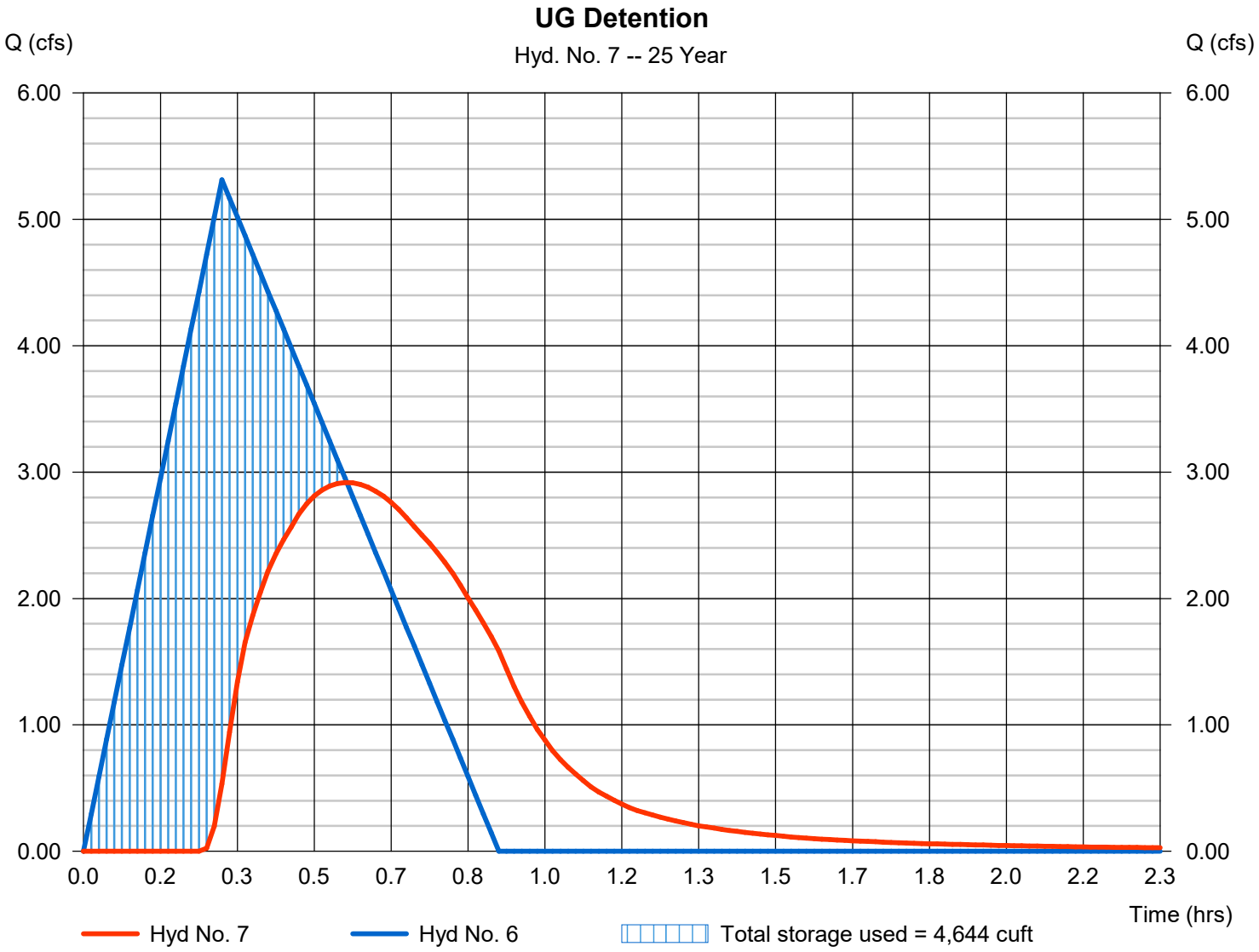
Hydrograph Report

Hyd. No. 7

UG Detention

Hydrograph type	=	Reservoir	Peak discharge	=	2.918 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.57 hrs
Time interval	=	1 min	Hyd. volume	=	6,464 cuft
Inflow hyd. No.	=	6 - Post-Dev B1	Max. Elevation	=	306.65 ft
Reservoir name	=	UG Detention	Max. Storage	=	4,644 cuft

Storage Indication method used.



Hydrograph Report

Hyd. No. 8

Post-Dev B2

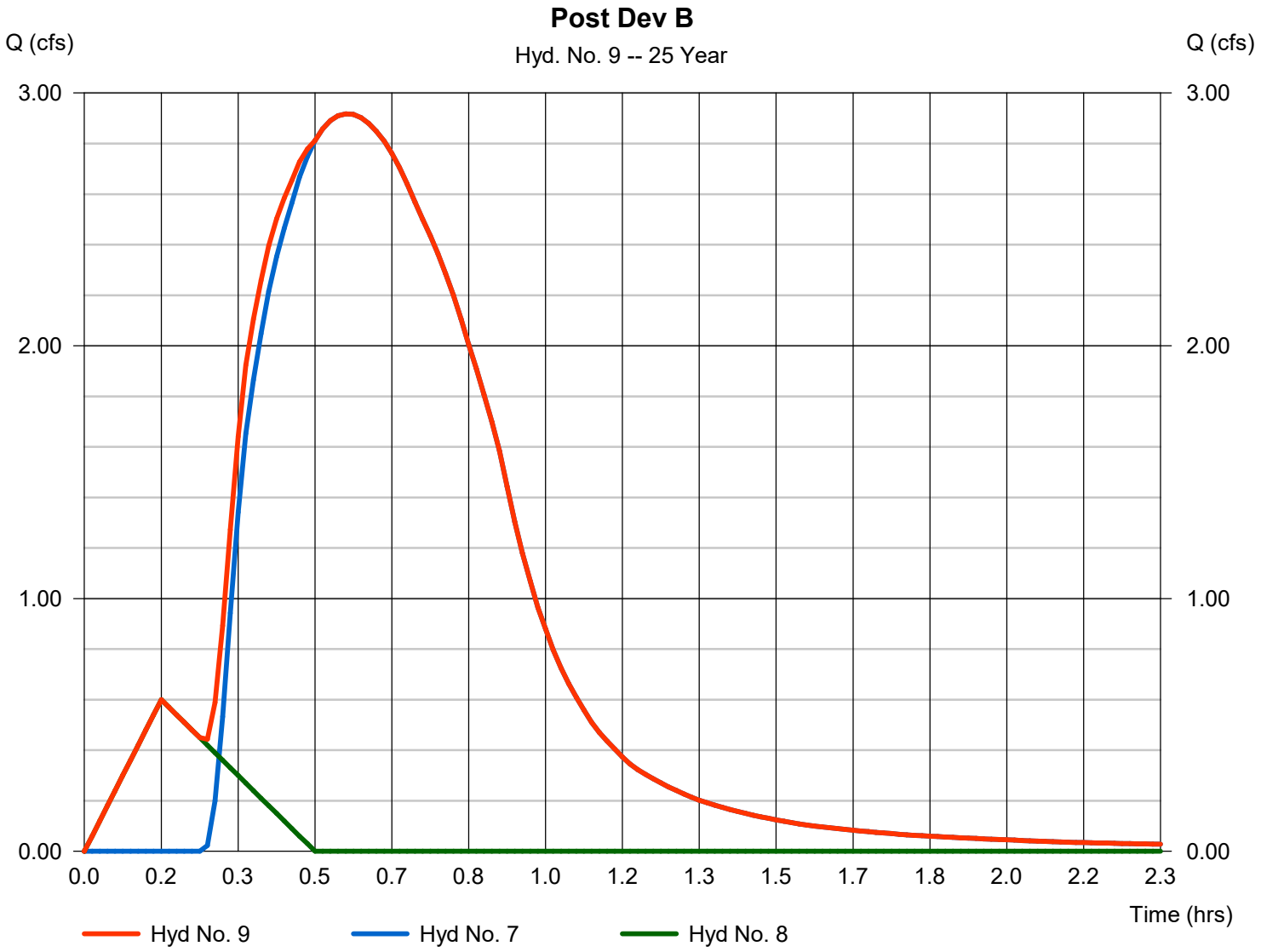
Hydrograph type	=	Rational	Peak discharge	=	0.600 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	540 cuft
Drainage area	=	0.307 ac	Runoff coeff.	=	0.3
Intensity	=	6.510 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

Hydrograph Report

Hyd. No. 9

Post Dev B

Hydrograph type	=	Combine	Peak discharge	=	2.918 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.57 hrs
Time interval	=	1 min	Hyd. volume	=	7,004 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	0.307 ac

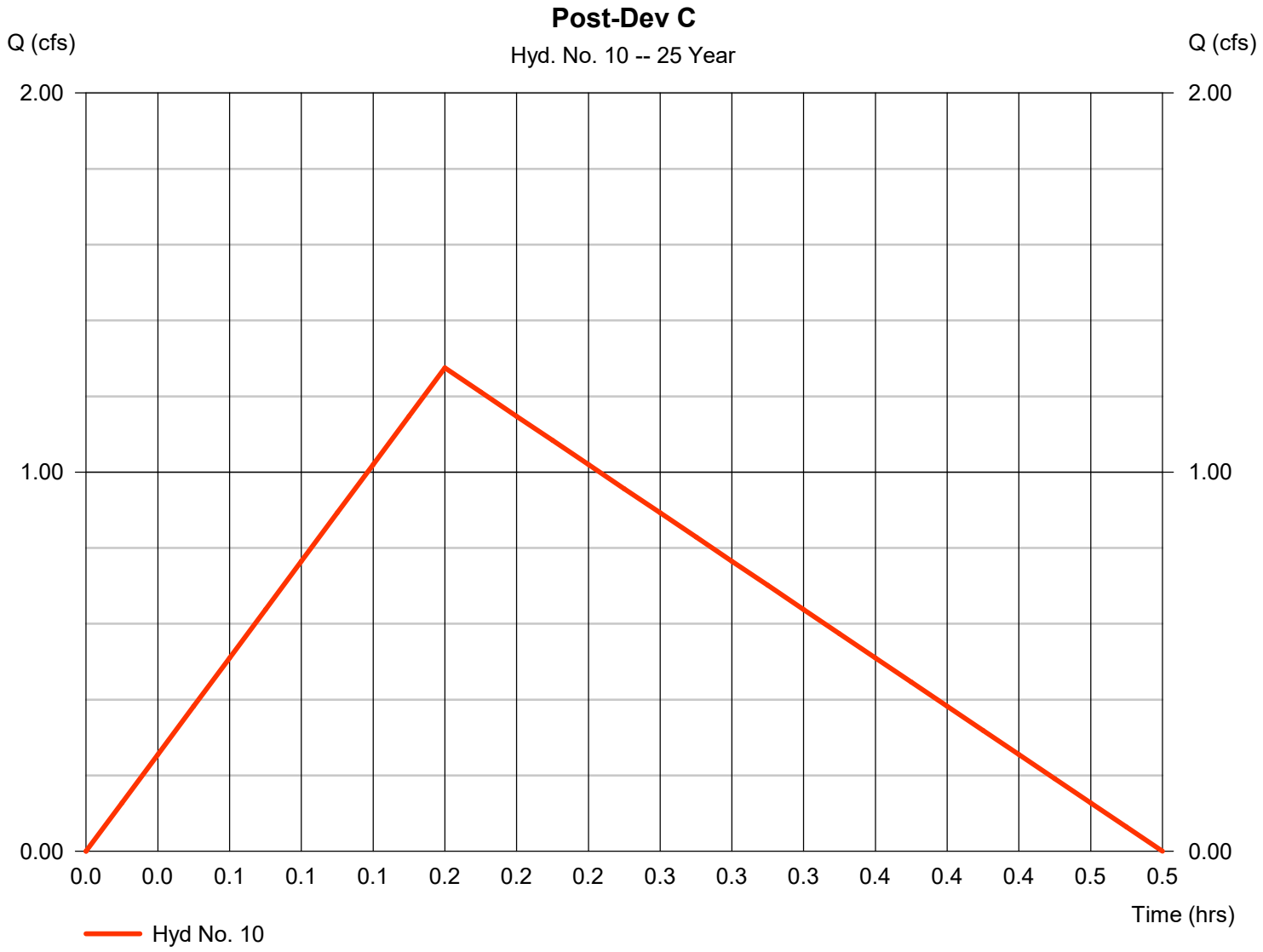


Hydrograph Report

Hyd. No. 10

Post-Dev C

Hydrograph type	=	Rational	Peak discharge	=	1.275 cfs
Storm frequency	=	25 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	1,148 cuft
Drainage area	=	0.544 ac	Runoff coeff.	=	0.36
Intensity	=	6.510 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

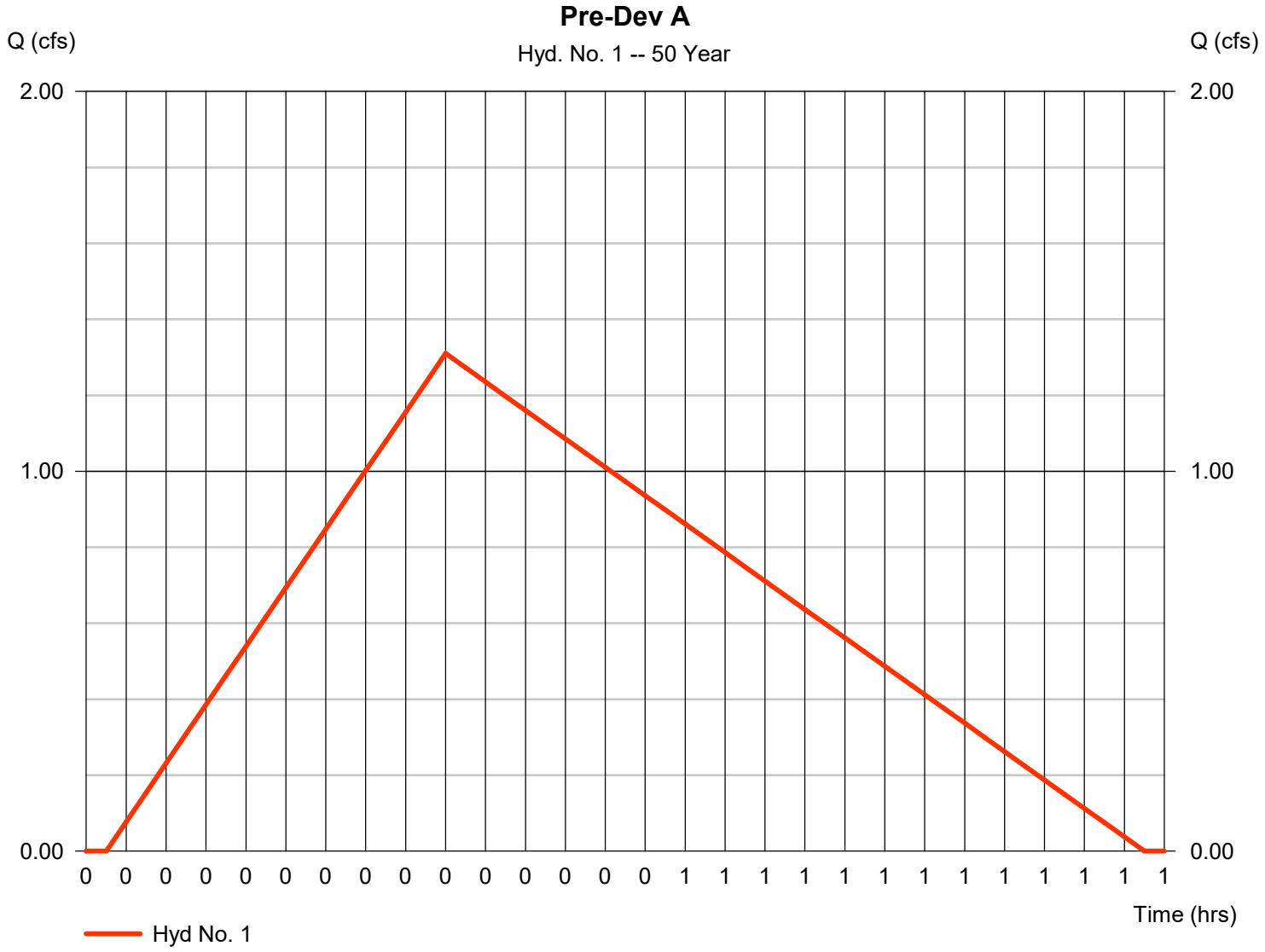


Hydrograph Report

Hyd. No. 1

Pre-Dev A

Hydrograph type	=	Rational	Peak discharge	=	1.310 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	2,090 cuft
Drainage area	=	0.816 ac	Runoff coeff.	=	0.3
Intensity	=	5.352 in/hr	Tc by TR55	=	17.73 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



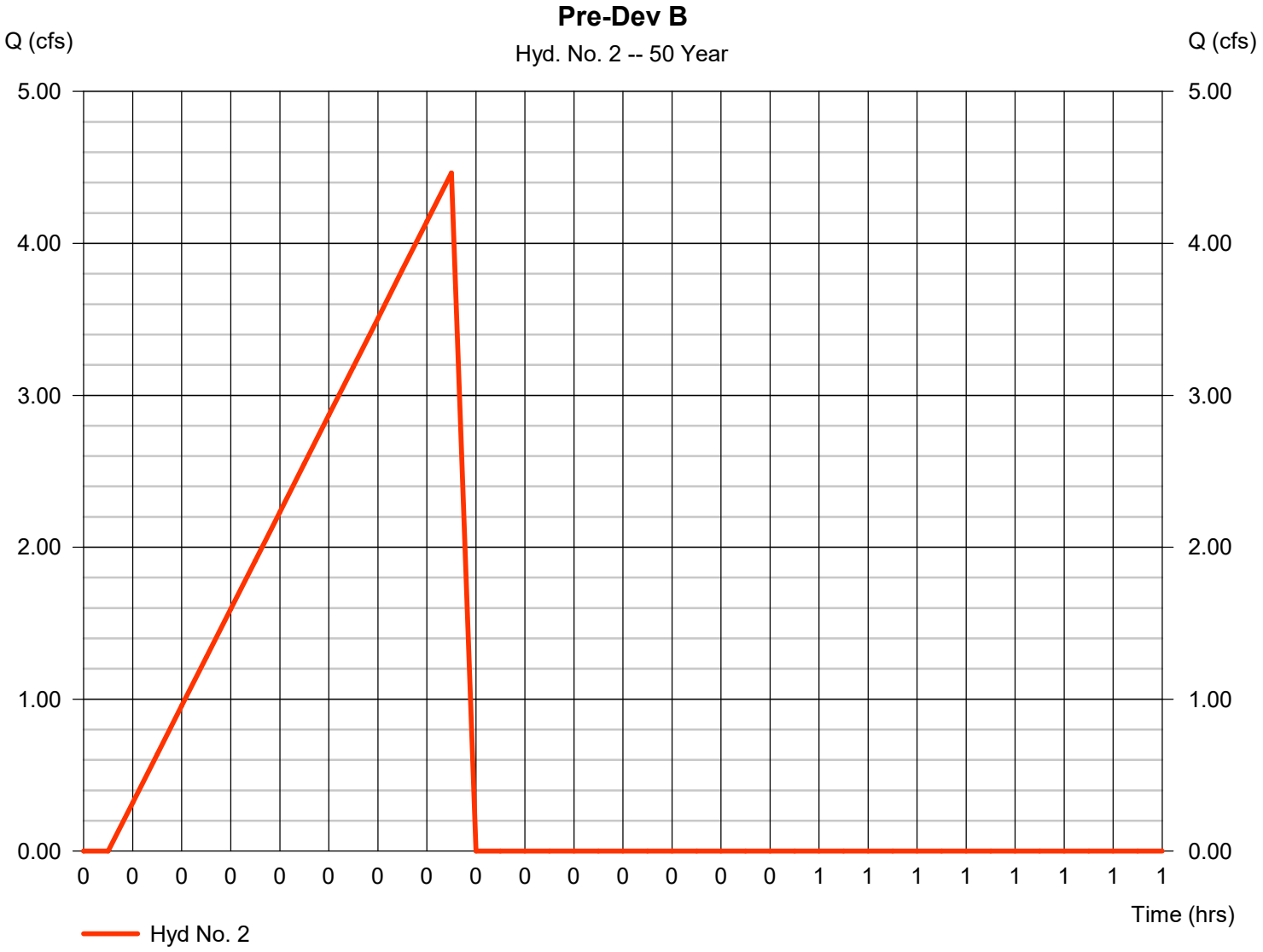
Hydrograph Report

Hyd. No. 2

Pre-Dev B

Hydrograph type	=	Rational	Peak discharge	=	4.463 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.25 hrs
Time interval	=	1 min	Hyd. volume	=	5,841 cuft
Drainage area	=	2.320 ac	Runoff coeff.	=	0.32*
Intensity	=	6.011 in/hr	Tc by TR55	=	14.54 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(1.790 x 0.30) + (0.145 x 0.90) + (0.381 x 0.20)] / 2.320



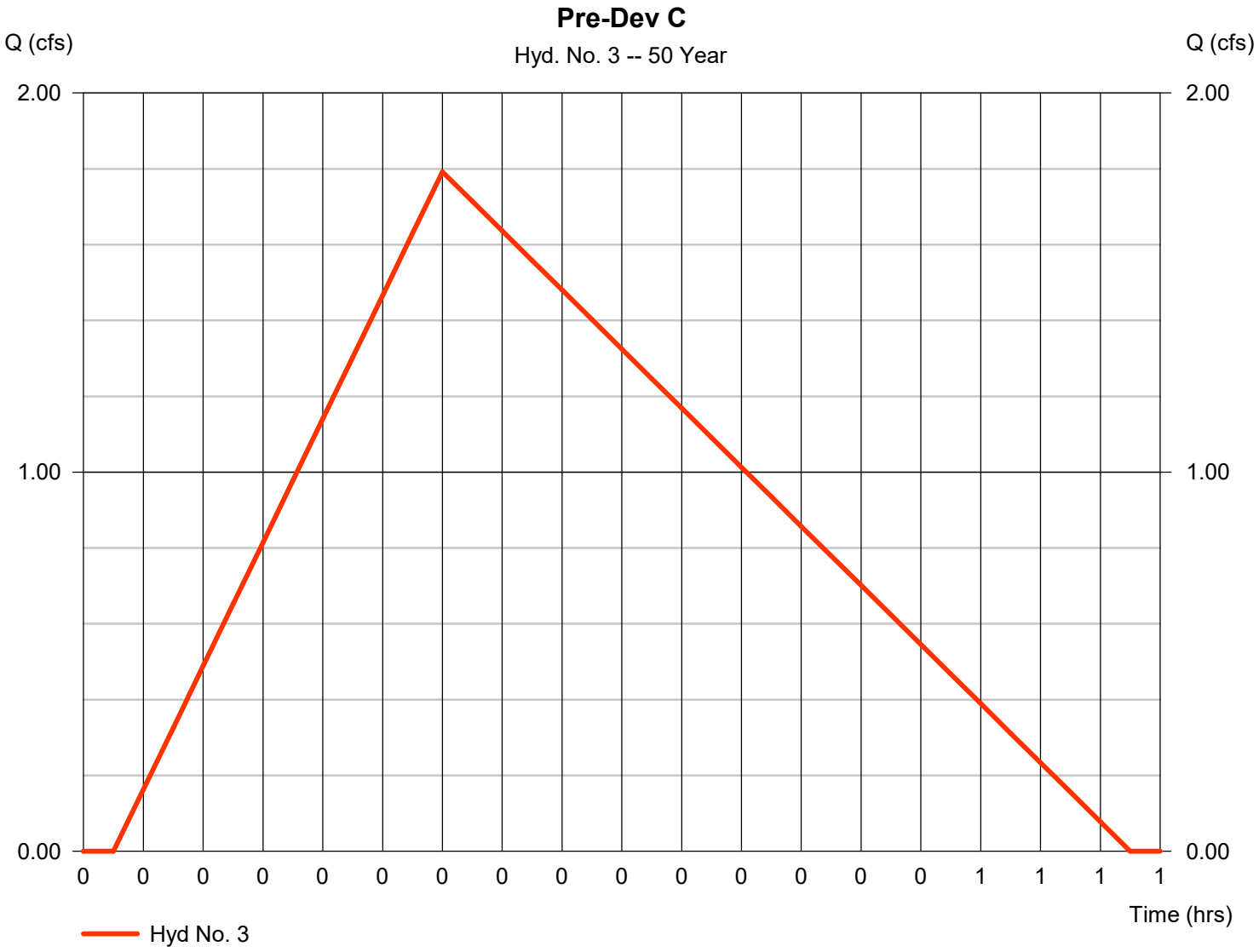
Hydrograph Report

Hyd. No. 3

Pre-Dev C

Hydrograph type	=	Rational	Peak discharge	=	1.792 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	1,911 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.32*
Intensity	=	6.748 in/hr	Tc by TR55	=	11.85 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(0.256 x 0.30) + (0.108 x 0.90) + (0.461 x 0.20)] / 0.830

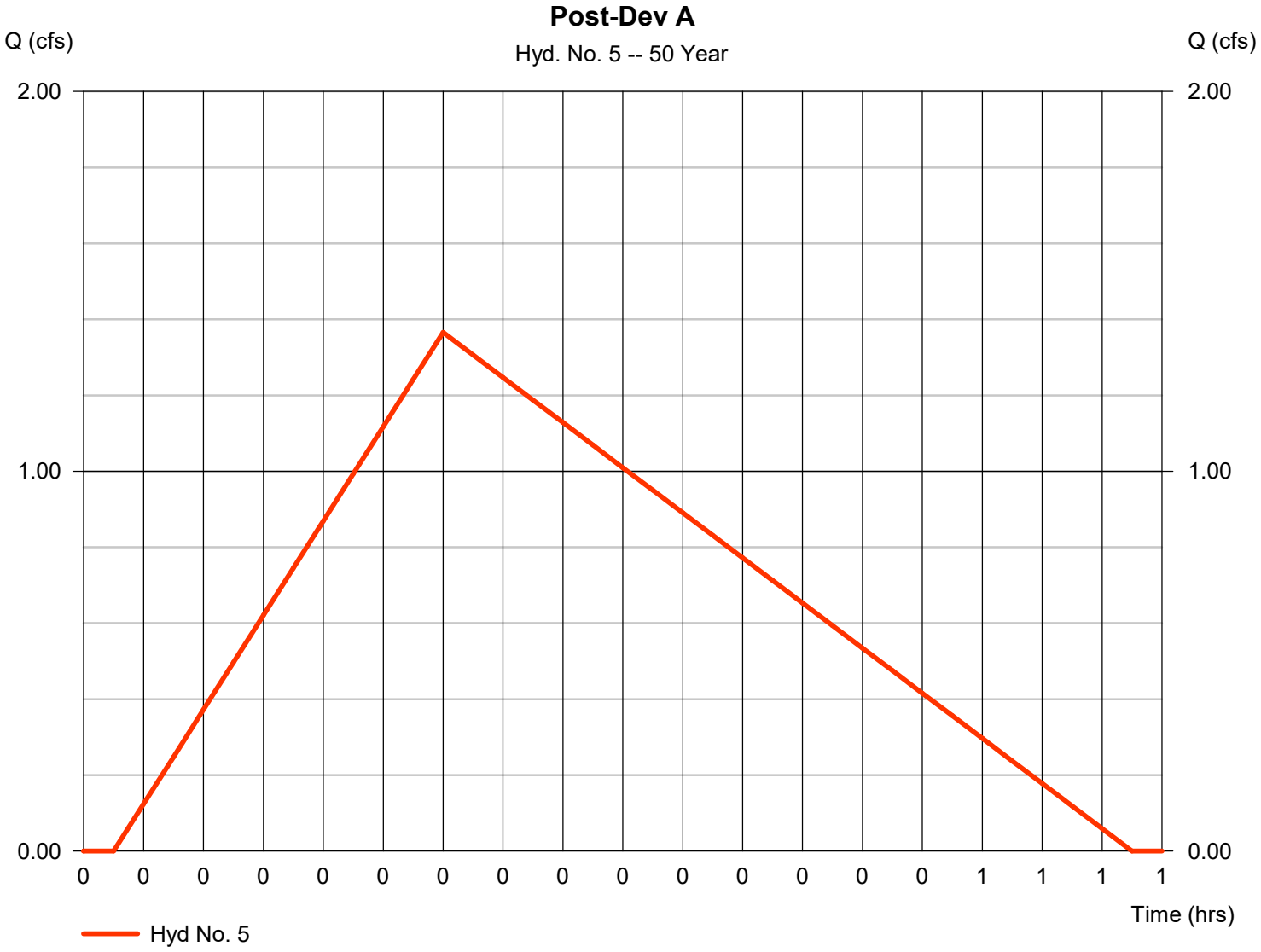


Hydrograph Report

Hyd. No. 5

Post-Dev A

Hydrograph type	=	Rational	Peak discharge	=	1.366 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	1,450 cuft
Drainage area	=	0.577 ac	Runoff coeff.	=	0.35
Intensity	=	6.763 in/hr	Tc by TR55	=	11.80 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

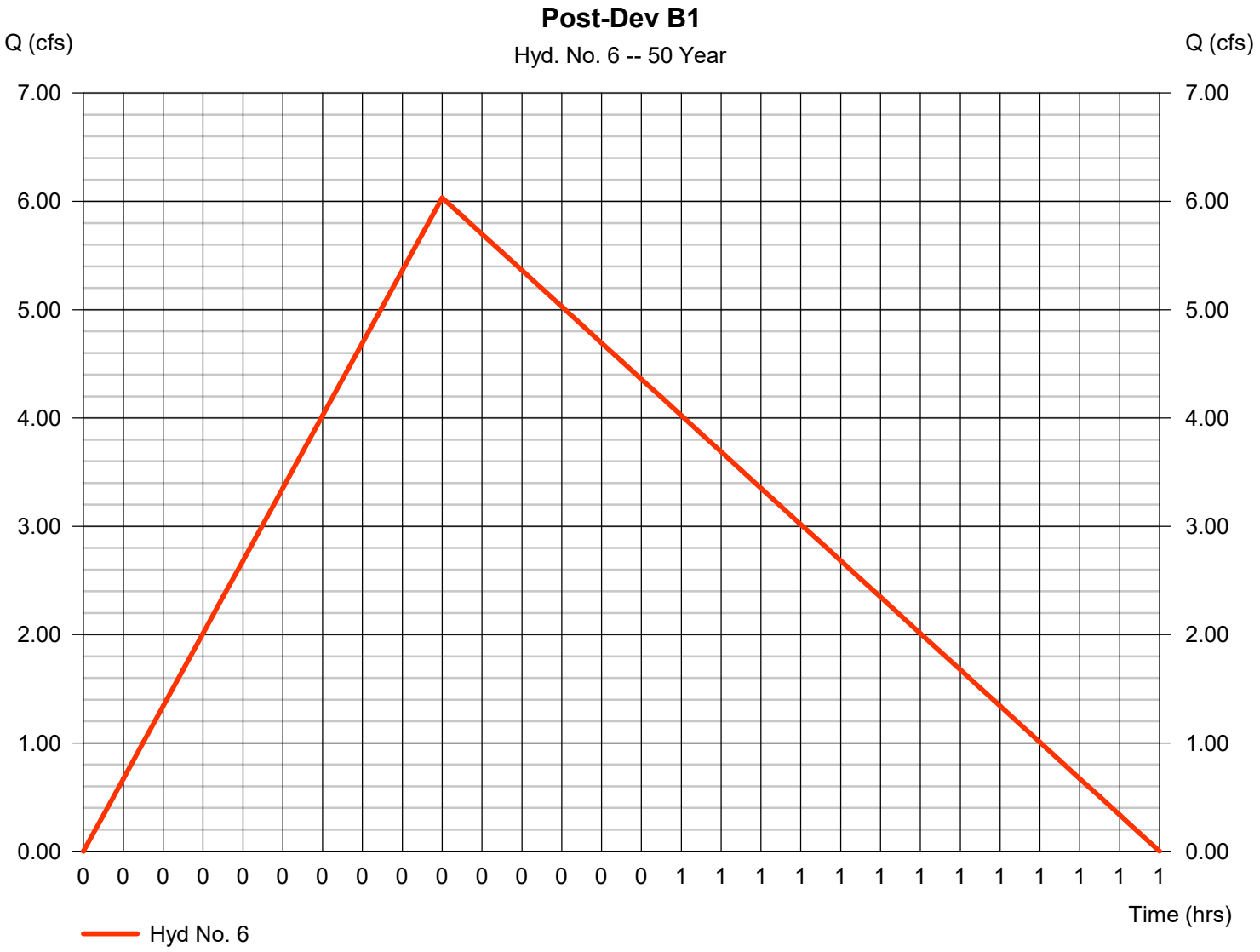


Hydrograph Report

Hyd. No. 6

Post-Dev B1

Hydrograph type	=	Rational	Peak discharge	=	6.034 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	9,843 cuft
Drainage area	=	2.539 ac	Runoff coeff.	=	0.45
Intensity	=	5.281 in/hr	Tc by TR55	=	18.12 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



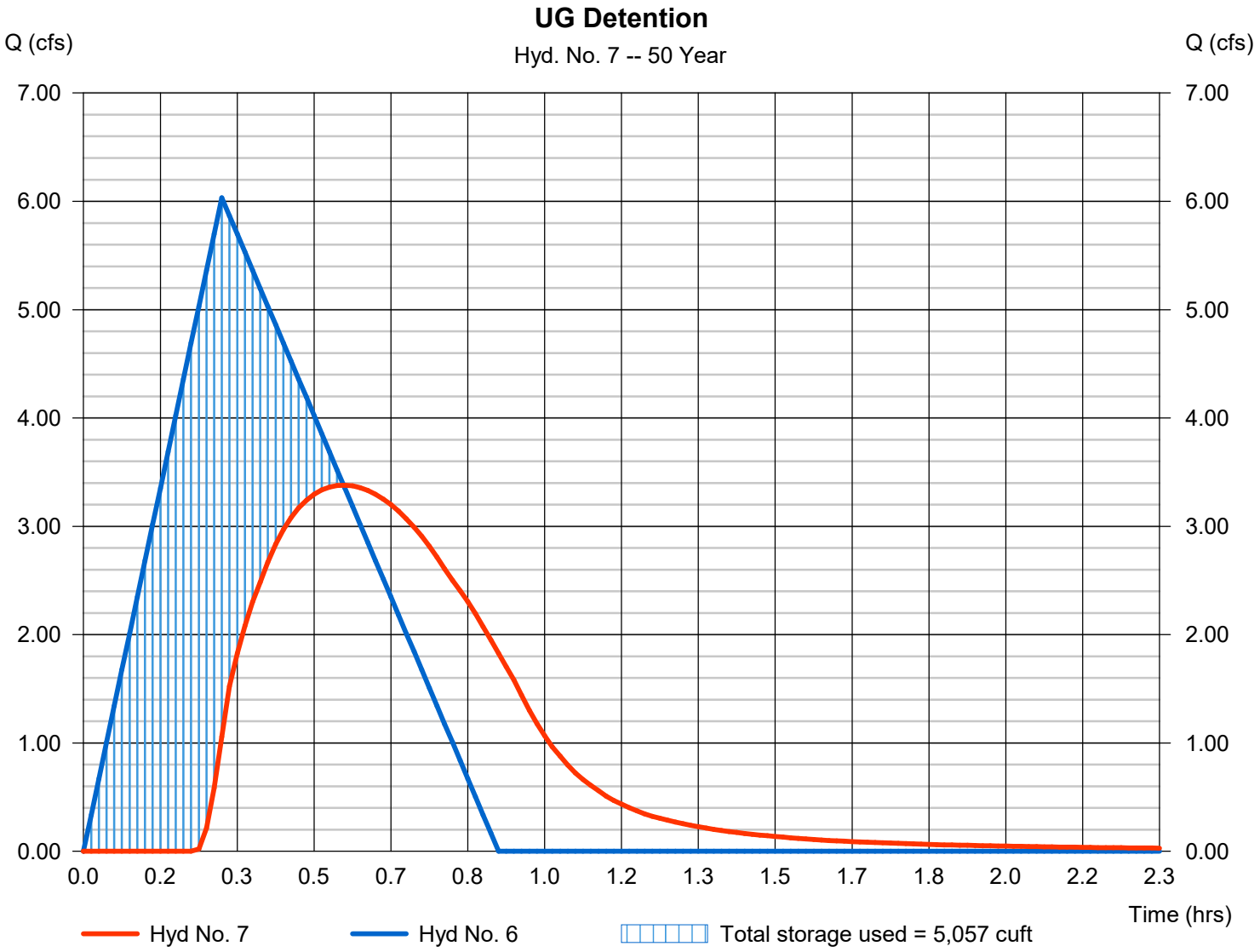
Hydrograph Report

Hyd. No. 7

UG Detention

Hydrograph type	=	Reservoir	Peak discharge	=	3.380 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.57 hrs
Time interval	=	1 min	Hyd. volume	=	7,631 cuft
Inflow hyd. No.	=	6 - Post-Dev B1	Max. Elevation	=	307.07 ft
Reservoir name	=	UG Detention	Max. Storage	=	5,057 cuft

Storage Indication method used.

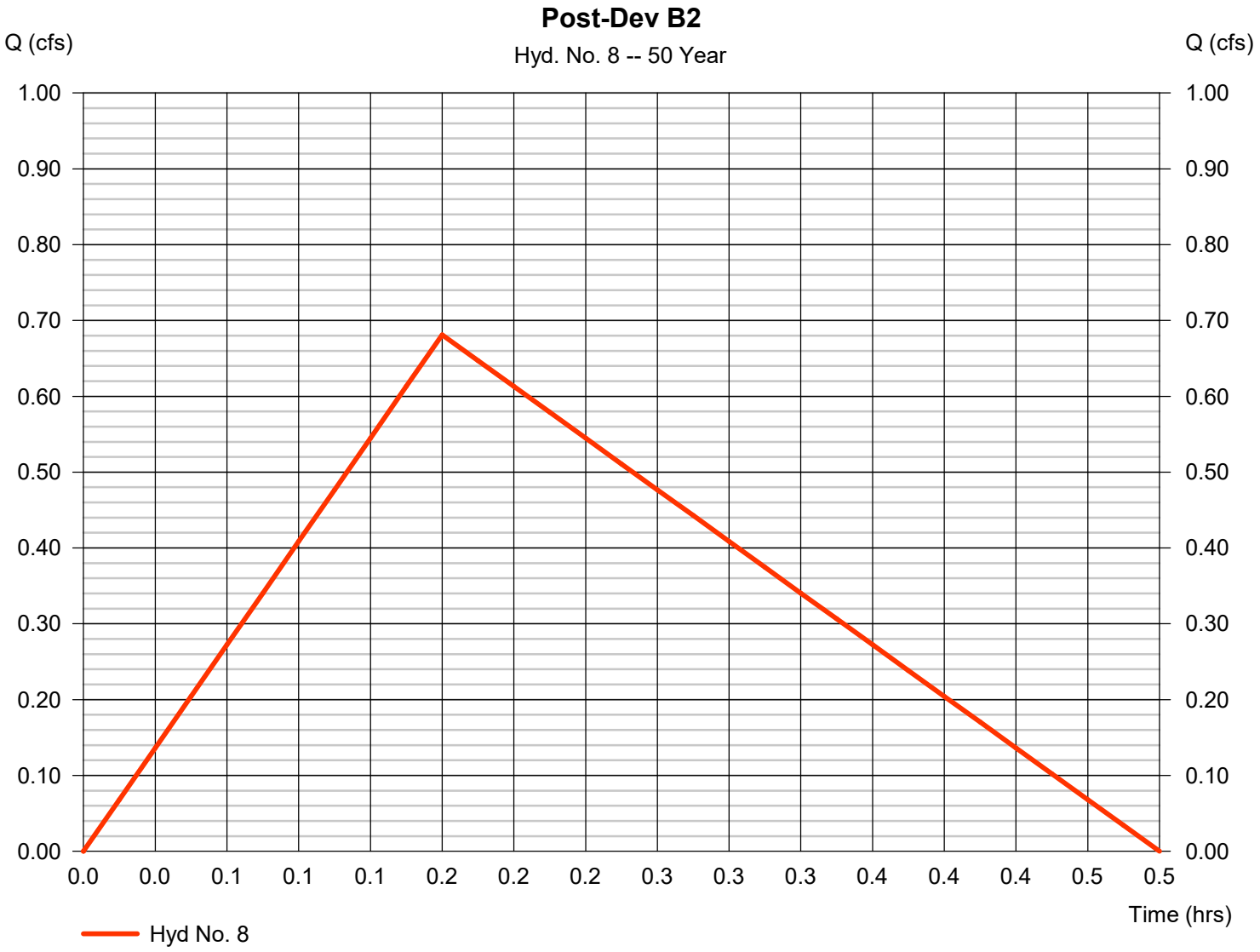


Hydrograph Report

Hyd. No. 8

Post-Dev B2

Hydrograph type	=	Rational	Peak discharge	=	0.681 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	613 cuft
Drainage area	=	0.307 ac	Runoff coeff.	=	0.3
Intensity	=	7.395 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

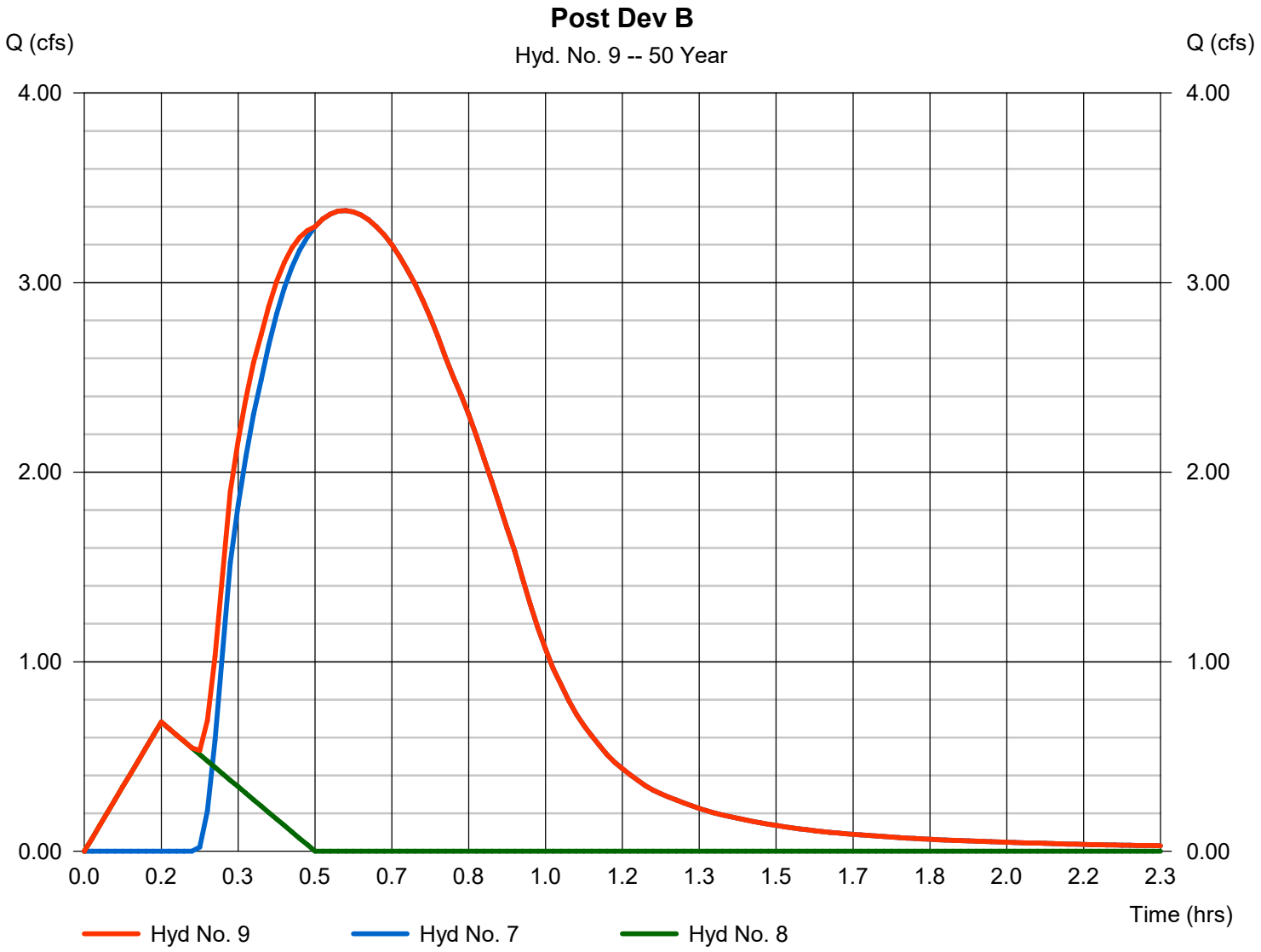


Hydrograph Report

Hyd. No. 9

Post Dev B

Hydrograph type	=	Combine	Peak discharge	=	3.380 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.57 hrs
Time interval	=	1 min	Hyd. volume	=	8,244 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	0.307 ac

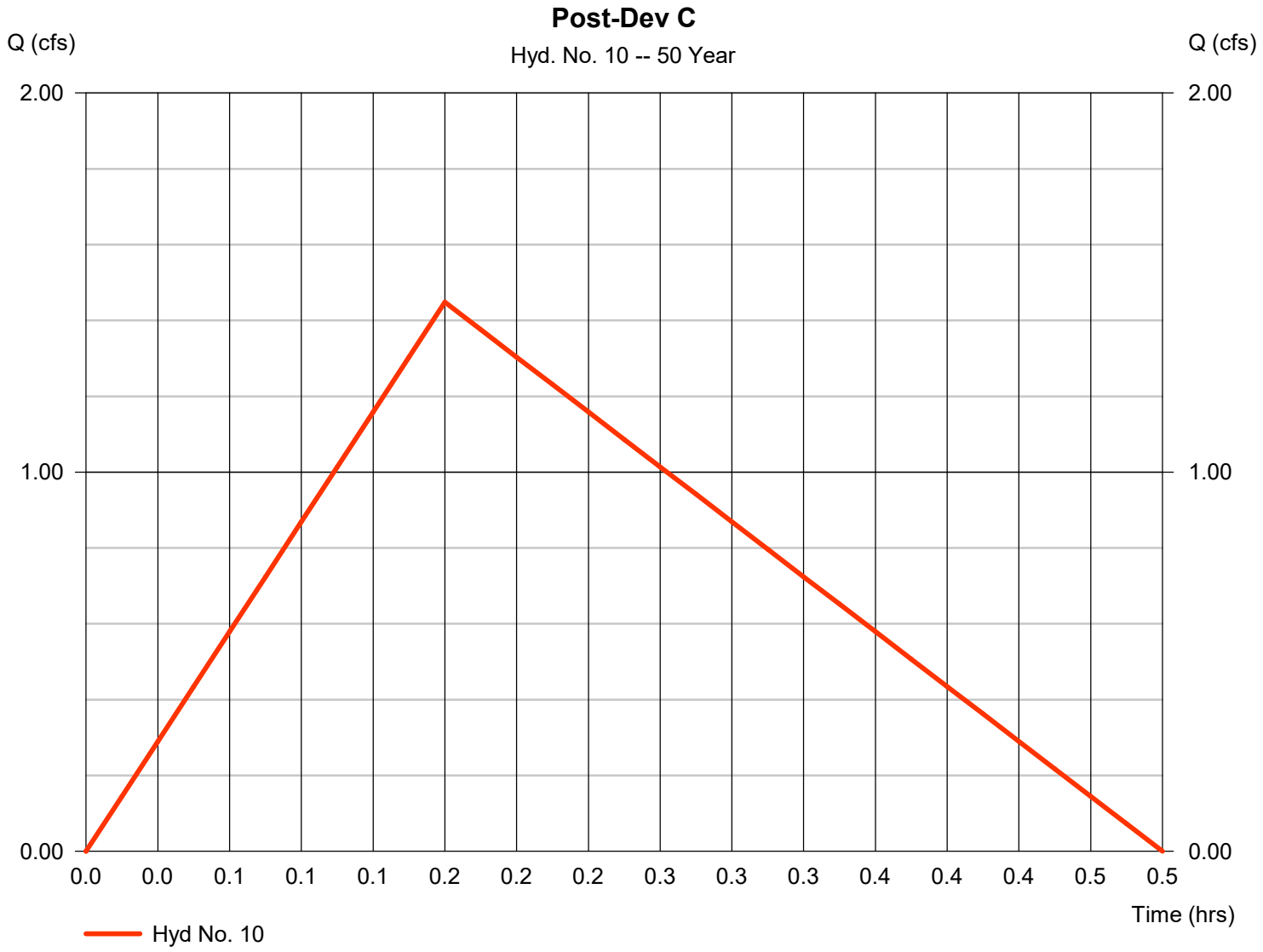


Hydrograph Report

Hyd. No. 10

Post-Dev C

Hydrograph type	=	Rational	Peak discharge	=	1.448 cfs
Storm frequency	=	50 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	1,303 cuft
Drainage area	=	0.544 ac	Runoff coeff.	=	0.36
Intensity	=	7.395 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

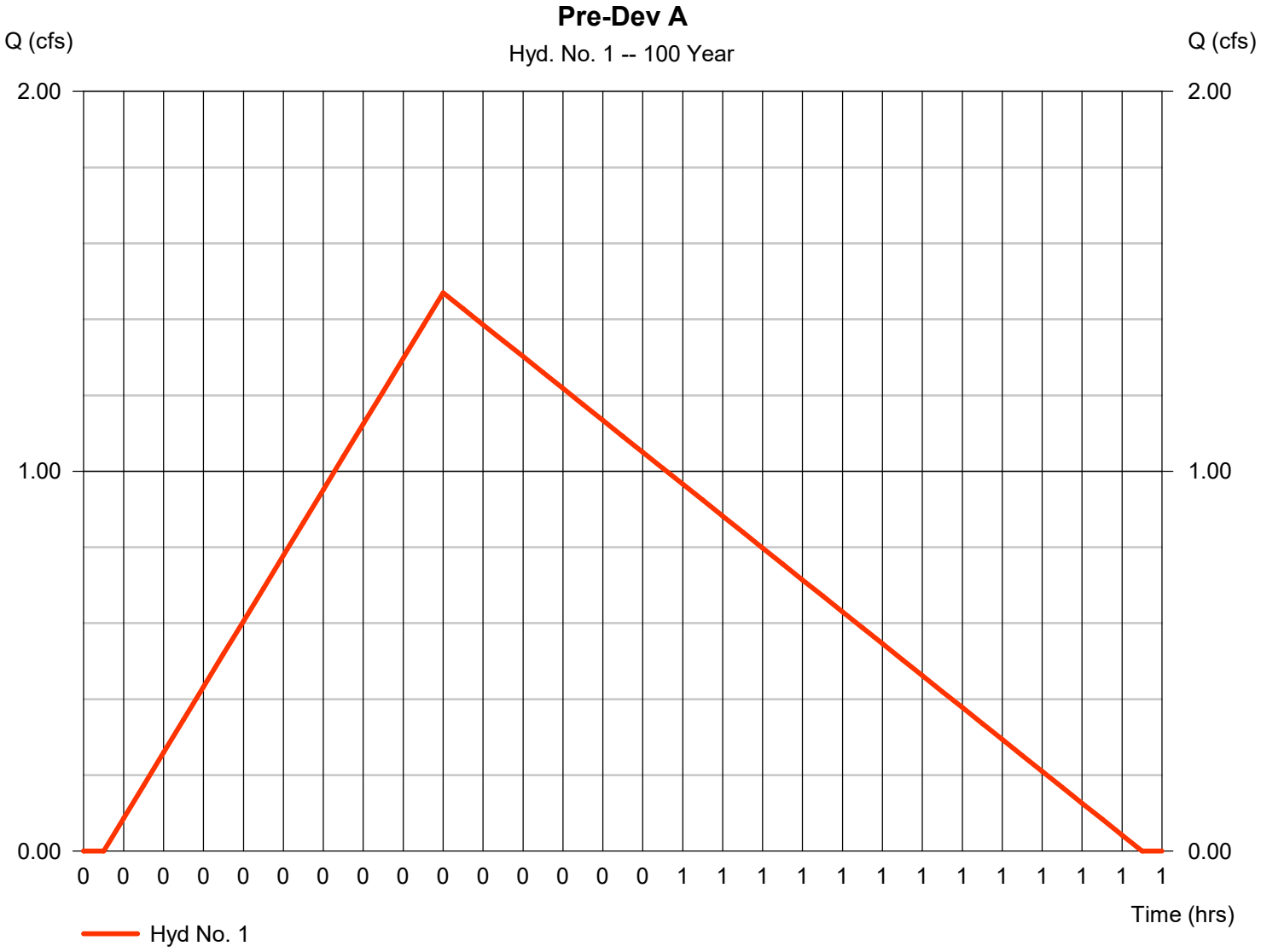


Hydrograph Report

Hyd. No. 1

Pre-Dev A

Hydrograph type	=	Rational	Peak discharge	=	1.470 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	2,345 cuft
Drainage area	=	0.816 ac	Runoff coeff.	=	0.3
Intensity	=	6.006 in/hr	Tc by TR55	=	17.73 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



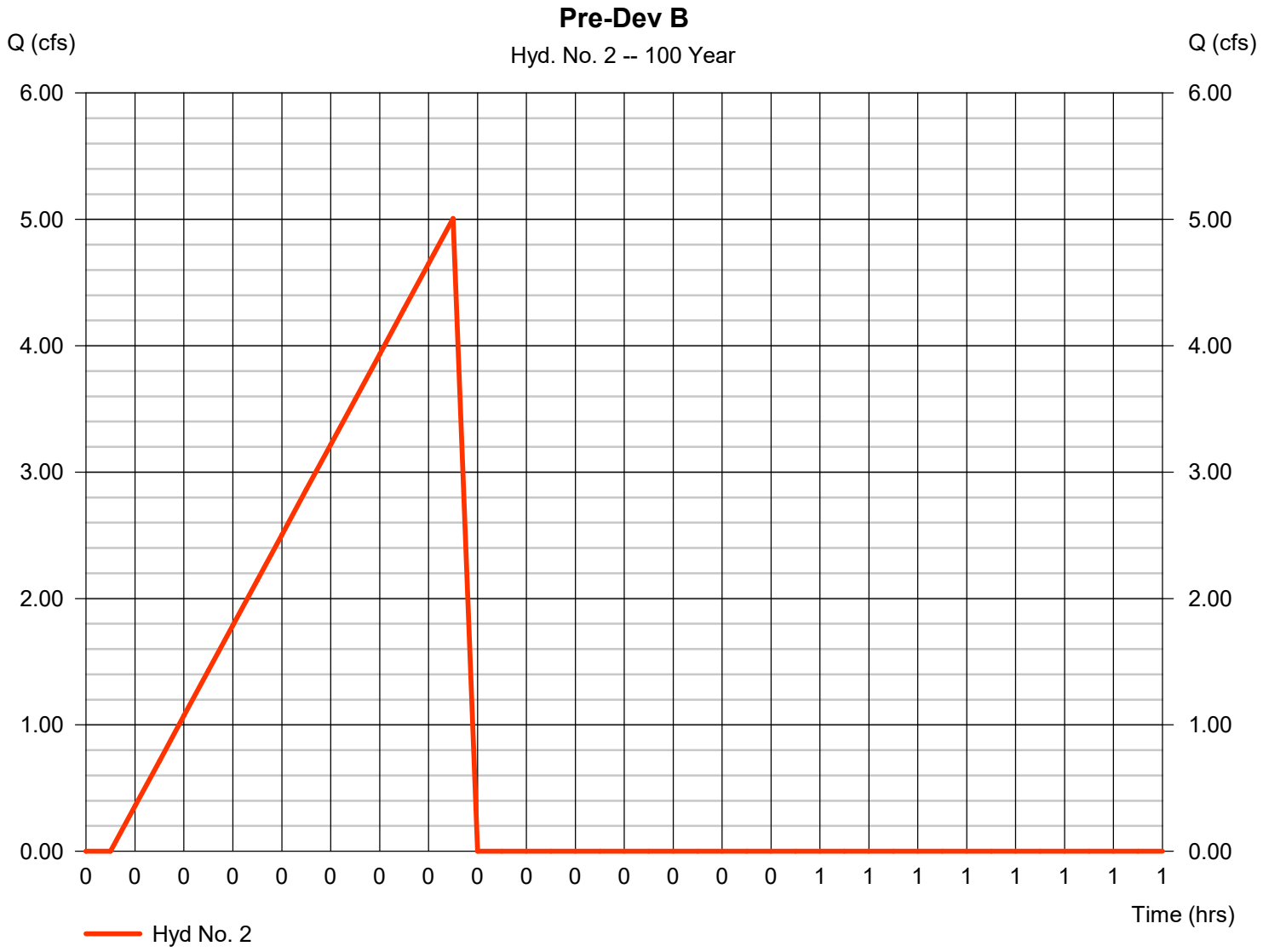
Hydrograph Report

Hyd. No. 2

Pre-Dev B

Hydrograph type	=	Rational	Peak discharge	=	5.006 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.25 hrs
Time interval	=	1 min	Hyd. volume	=	6,552 cuft
Drainage area	=	2.320 ac	Runoff coeff.	=	0.32*
Intensity	=	6.743 in/hr	Tc by TR55	=	14.54 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(1.790 x 0.30) + (0.145 x 0.90) + (0.381 x 0.20)] / 2.320



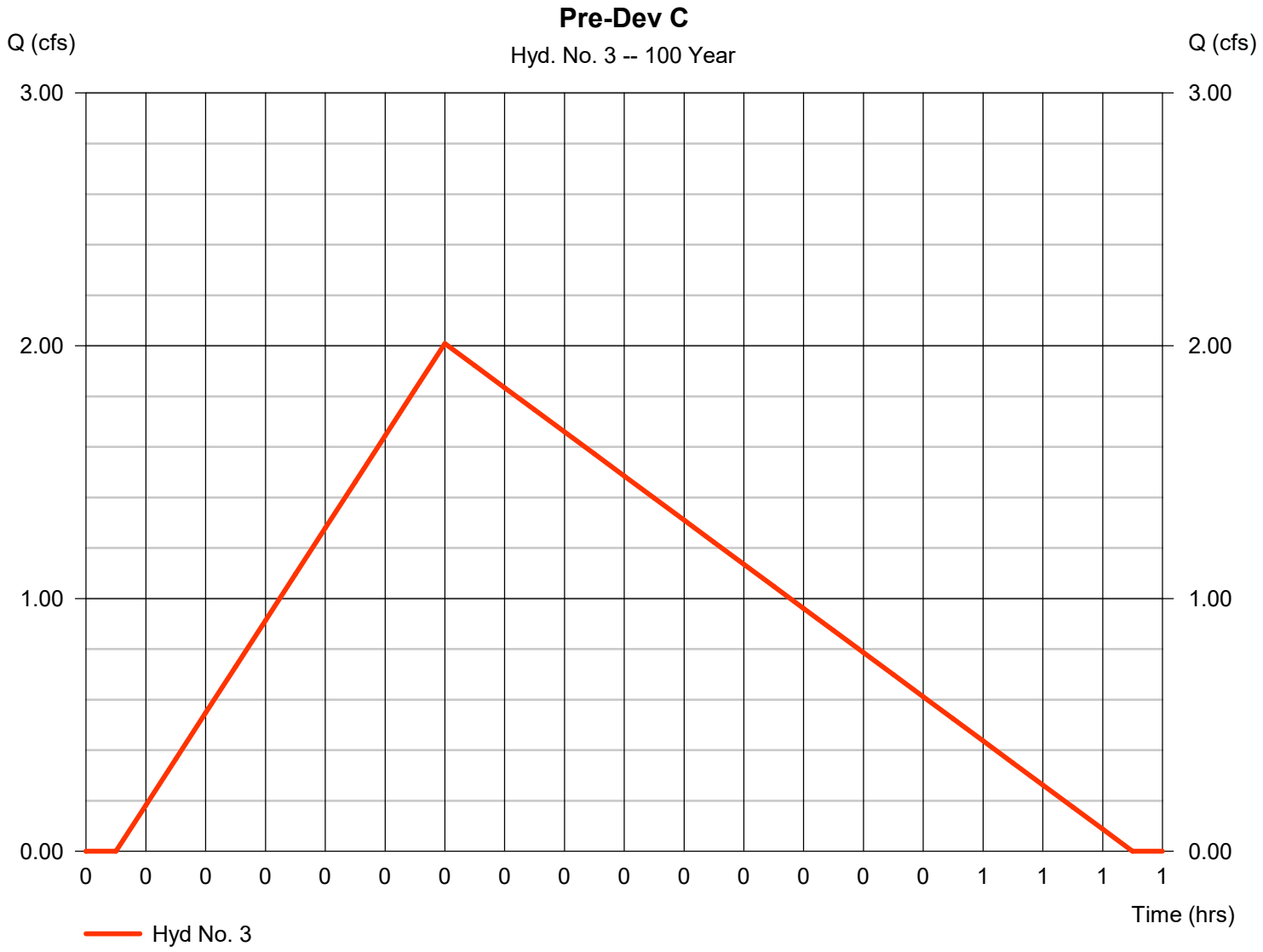
Hydrograph Report

Hyd. No. 3

Pre-Dev C

Hydrograph type	=	Rational	Peak discharge	=	2.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	2,142 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.32*
Intensity	=	7.564 in/hr	Tc by TR55	=	11.85 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

* Composite (Area/C) = [(0.256 x 0.30) + (0.108 x 0.90) + (0.461 x 0.20)] / 0.830

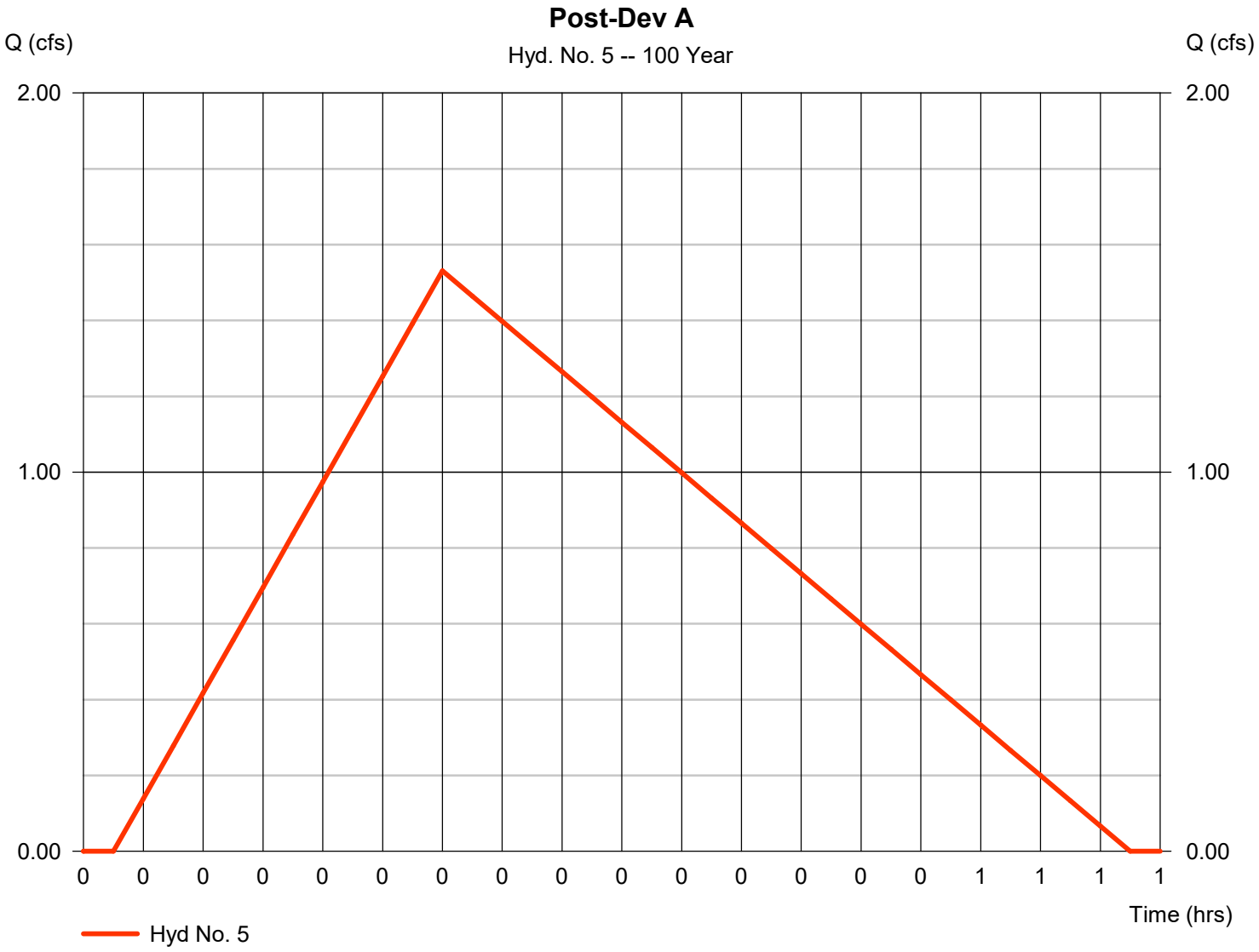


Hydrograph Report

Hyd. No. 5

Post-Dev A

Hydrograph type	=	Rational	Peak discharge	=	1.531 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.20 hrs
Time interval	=	1 min	Hyd. volume	=	1,626 cuft
Drainage area	=	0.577 ac	Runoff coeff.	=	0.35
Intensity	=	7.581 in/hr	Tc by TR55	=	11.80 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

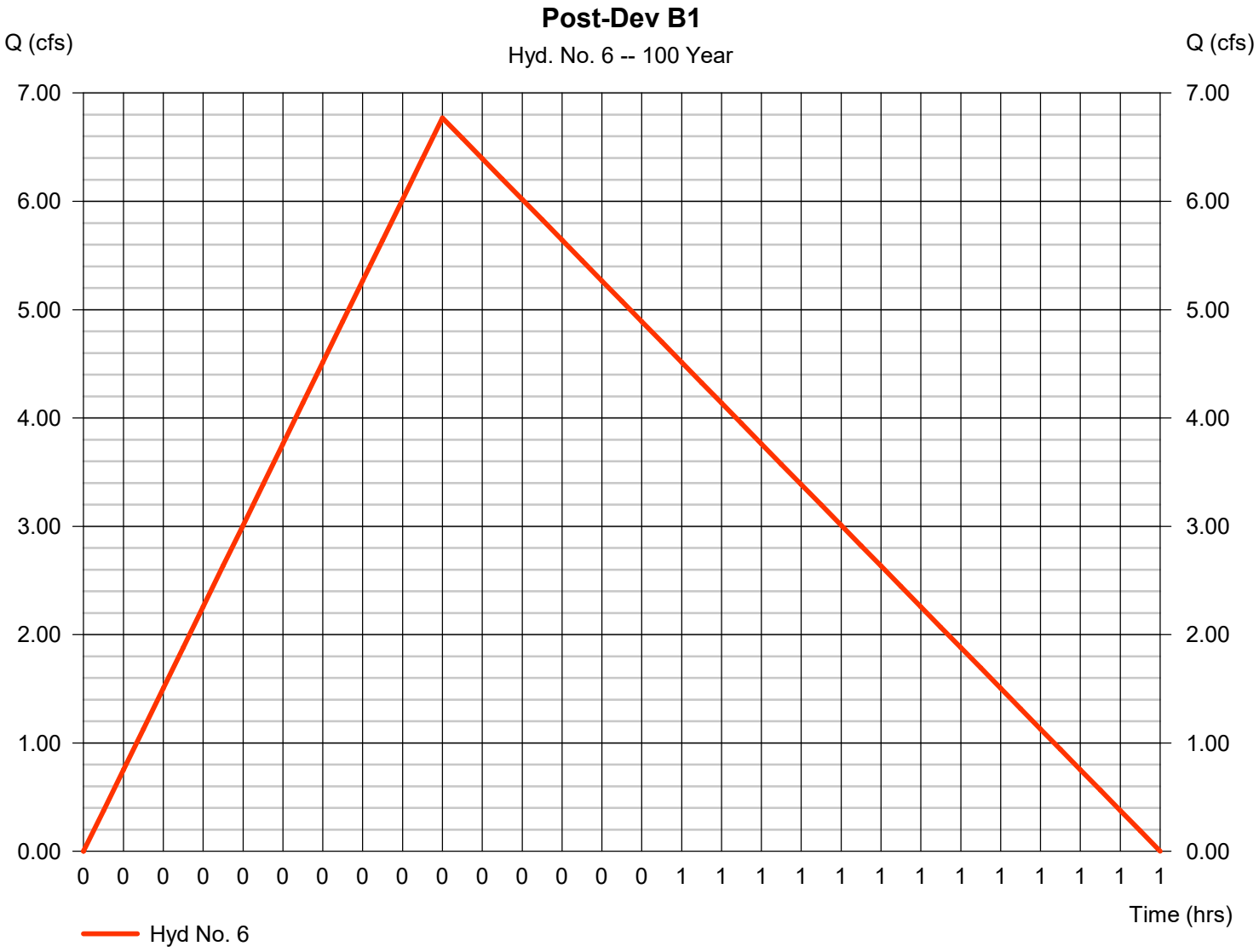


Hydrograph Report

Hyd. No. 6

Post-Dev B1

Hydrograph type	=	Rational	Peak discharge	=	6.771 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.30 hrs
Time interval	=	1 min	Hyd. volume	=	11,045 cuft
Drainage area	=	2.539 ac	Runoff coeff.	=	0.45
Intensity	=	5.926 in/hr	Tc by TR55	=	18.12 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2



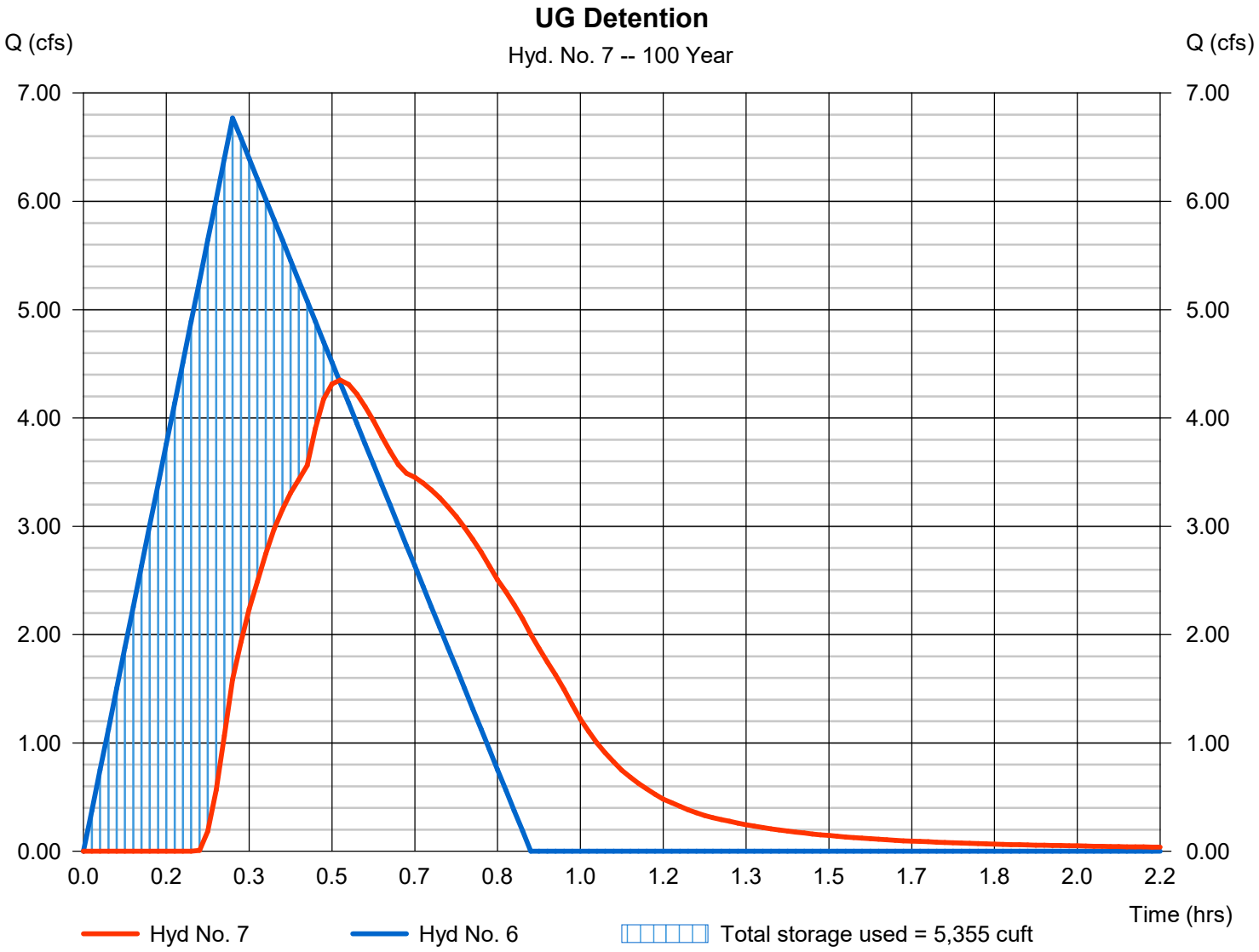
Hydrograph Report

Hyd. No. 7

UG Detention

Hydrograph type	=	Reservoir	Peak discharge	=	4.350 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.52 hrs
Time interval	=	1 min	Hyd. volume	=	8,825 cuft
Inflow hyd. No.	=	6 - Post-Dev B1	Max. Elevation	=	307.38 ft
Reservoir name	=	UG Detention	Max. Storage	=	5,355 cuft

Storage Indication method used.

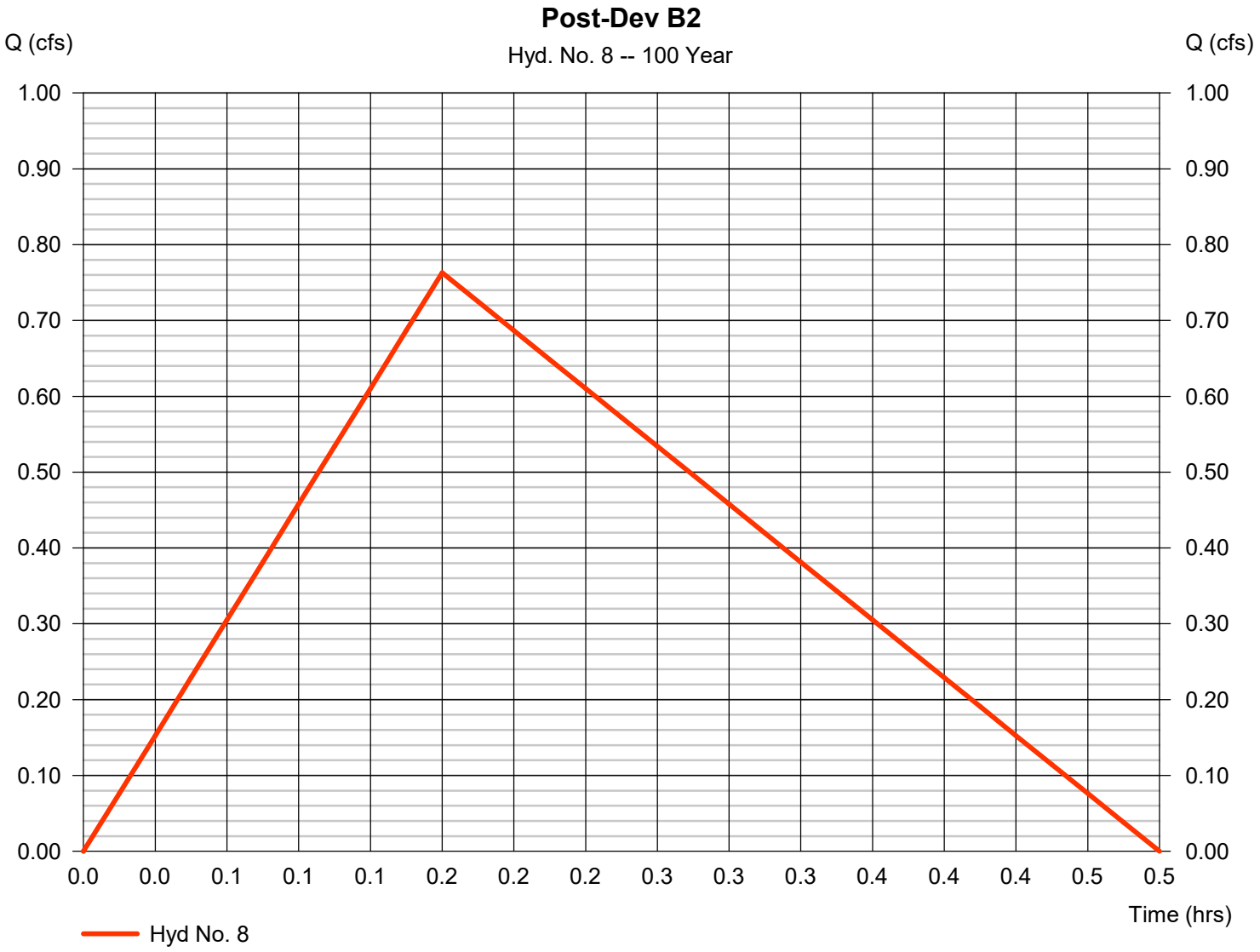


Hydrograph Report

Hyd. No. 8

Post-Dev B2

Hydrograph type	=	Rational	Peak discharge	=	0.763 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	687 cuft
Drainage area	=	0.307 ac	Runoff coeff.	=	0.3
Intensity	=	8.284 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

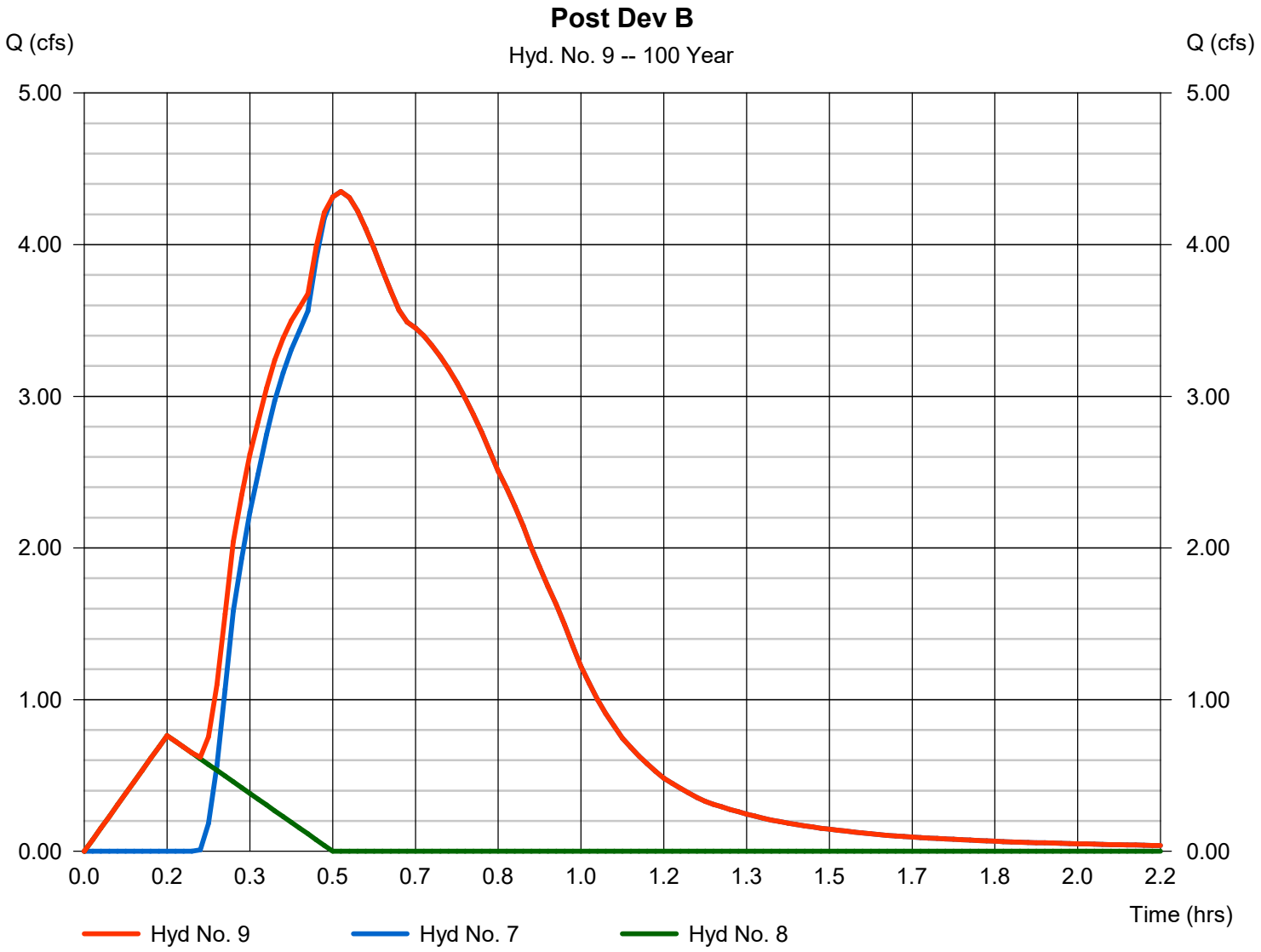


Hydrograph Report

Hyd. No. 9

Post Dev B

Hydrograph type	= Combine	Peak discharge	= 4.350 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.52 hrs
Time interval	= 1 min	Hyd. volume	= 9,512 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 0.307 ac



Hydrograph Report

Hyd. No. 10

Post-Dev C

Hydrograph type	=	Rational	Peak discharge	=	1.622 cfs
Storm frequency	=	100 yrs	Time to peak	=	0.17 hrs
Time interval	=	1 min	Hyd. volume	=	1,460 cuft
Drainage area	=	0.544 ac	Runoff coeff.	=	0.36
Intensity	=	8.284 in/hr	Tc by User	=	10.00 min
IDF Curve	=	West Hartford_IDF.IDF	Asc/Rec limb fact	=	1/2

APPENDIX C

Storm Sewer System Design

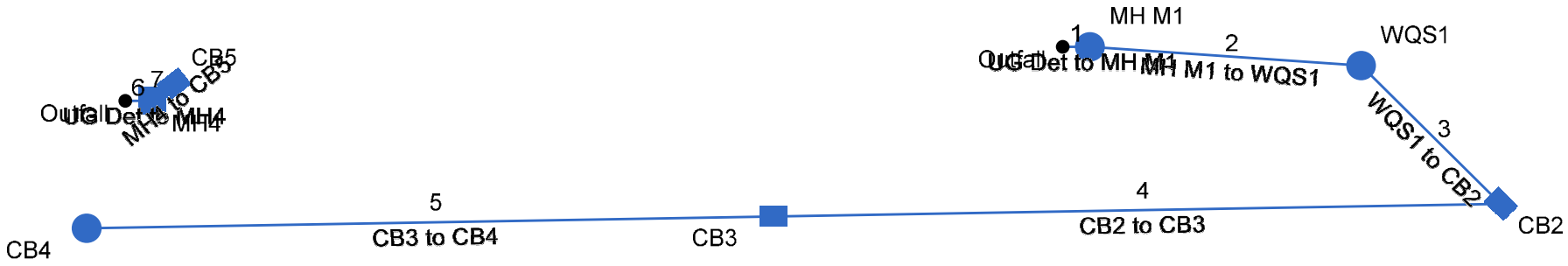
SUBJECT	380 Tunxis Rd, West Hartford		SHEET NO.	1 OF	1
	Pre and Post Development		COMPUTED BY	BH DATE	1/7/2019
JOB NO.	2180652		CHECKED BY	JSP DATE	1/7/2019

DATA SHEET FOR RATIONAL METHOD STORM DRAINAGE DESIGN

Q = CiA

NODE		AREA	RUNOFF COEFFICIENT C			TIME OF CONCENTRATION (TR-55)					
AREA I.D.	AREA (S.F.)	ACRES	DESCRIPTION	C VALUE	TOTAL AC	ELEV. DIFF. FT	LENGTH FT	SLOPE %	COVER	TIME MIN.	Flow Type
WQS-1	2569	0.059	PAVEMENT	0.9	0.053	(Minimum Tc for pavement)				5	
(Type C Top)	0	0.000	GRASS	0.3	0.000						
TOTAL	2569	0.059		0.9	0.053						
CB-2	6922	0.159	PAVEMENT	0.9	0.143	5	150	3	Grass	17.6	Sheet
(Type C)	29525	0.678	GRASS	0.3	0.203	22	121	18	Grass	0.29	Shallow
						5	149	3	Grass	0.89	Shallow
						1	39	3	Impv	0.18	Shallow
TOTAL	36447	0.837		0.41	0.346	(Tc Calulation from Hydraflow)				19	(Total)
CB-3	4351	0.100	PAVEMENT	0.9	0.090	10	150	7	Grass	12.6	Sheet
(Type C)	29037	0.667	GRASS	0.3	0.200	8	37	22	Grass	0.08	Shallow
						16	32	50	Grass	0.05	Shallow
						3	140	2	Grass	1.02	Shallow
TOTAL	33388	0.766		0.38	0.290	LI				13.7	(Total)
CB-4	8848	0.203	PAVEMENT	0.9	0.183	19	148	13	Grass	9.7	Sheet
(Type C)	24157	0.555	GRASS	0.3	0.166	3	88	3	Grass	0.52	Shallow
						1	78	1	Impv	0.64	Shallow
TOTAL	33005	0.758		0.46	0.349	(Tc Calulation from Hydraflow)				10.9	(Total)
CB-5	4844	0.111	PAVEMENT	0.9	0.100	(Minimum Tc for pavement)				5	
(Type C)	0	0.000	GRASS	0.3	0.000						
TOTAL	4844	0.111		0.9	0.100						
TOTAL		2.531									

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Storm Sewer.stm	Number of lines: 7	Date: 1/9/2019

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	4.000	0.000	MH	0.00	0.00	0.00	0.0	303.90	0.00	303.90	24	Cir	0.013	0.15	309.00	UG Det to MH M1
2	1	40.000	4.000	Comb	0.00	0.06	0.90	5.0	303.90	0.75	304.20	18	Cir	0.013	1.58	308.00	MH M1 to WQS1
3	2	29.000	41.000	Comb	0.00	1.60	0.40	19.0	304.20	1.03	304.50	15	Cir	0.013	1.50	308.00	WQS1 to CB2
4	3	107.000	134.000	Comb	0.00	0.77	0.38	13.7	304.50	1.03	305.60	12	Cir	0.013	0.50	309.09	CB2 to CB3
5	4	101.000	0.000	Comb	0.00	0.76	0.46	10.9	305.60	1.29	306.90	12	Cir	0.013	1.00	310.30	CB3 to CB4
6	End	4.000	0.000	MH	0.00	0.00	0.00	0.0	303.90	0.00	303.90	24	Cir	0.013	0.67	310.70	UG Det to MH4
7	6	4.000	-38.000	Comb	0.00	0.11	0.90	5.0	303.90	60.00	306.30	12	Cir	0.013	1.00	310.30	MH4 to CB5

Project File: Storm Sewer.stm | Number of lines: 7 | Date: 1/9/2019

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	UG Det to MH M1	4.92	24	Cir	4.000	303.90	303.90	0.000	306.20*	306.20*	0.01	306.21	End	Manhole
2	MH M1 to WQS1	4.95	18	Cir	40.000	303.90	304.20	0.750	306.21*	306.30*	0.19	306.49	1	Combination
3	WQS1 to CB2	4.77	15	Cir	29.000	304.20	304.50	1.034	306.49*	306.65*	0.35	307.00	2	Combination
4	CB2 to CB3	2.89	12	Cir	107.000	304.50	305.60	1.028	307.00*	307.71*	0.11	307.81	3	Combination
5	CB3 to CB4	1.79	12	Cir	101.000	305.60	306.90	1.287	307.81*	308.07*	0.08	308.15	4	Combination
6	UG Det to MH4	0.73	24	Cir	4.000	303.90	303.90	0.000	306.20*	306.20*	0.00	306.20	End	Manhole
7	MH4 to CB5	0.74	12	Cir	4.000	303.90	306.30	60.000	306.20	306.66	0.13	306.66	6	Combination

Project File: Storm Sewer.stm | Number of lines: 7 | Run Date: 1/9/2019

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	4.000	0.00	3.19	0.00	0.00	1.34	0.0	19.4	3.7	4.92	0.00	1.57	24	0.00	303.90	303.90	306.20	306.20	309.00	309.00	UG Det to MH M1
2	1	40.000	0.06	3.19	0.90	0.05	1.34	5.0	19.1	3.7	4.95	9.09	2.80	18	0.75	303.90	304.20	306.21	306.30	309.00	308.00	MH M1 to WQS1
3	2	29.000	1.60	3.13	0.40	0.64	1.28	19.0	19.0	3.7	4.77	6.57	3.89	15	1.03	304.20	304.50	306.49	306.65	308.00	308.00	WQS1 to CB2
4	3	107.000	0.77	1.53	0.38	0.29	0.64	13.7	13.7	4.5	2.89	3.61	3.69	12	1.03	304.50	305.60	307.00	307.71	308.00	309.09	CB2 to CB3
5	4	101.000	0.76	0.76	0.46	0.35	0.35	10.9	10.9	5.1	1.79	4.04	2.28	12	1.29	305.60	306.90	307.81	308.07	309.09	310.30	CB3 to CB4
6	End	4.000	0.00	0.11	0.00	0.00	0.10	0.0	5.1	7.4	0.73	0.00	0.23	24	0.00	303.90	303.90	306.20	306.20	310.70	310.70	UG Det to MH4
7	6	4.000	0.11	0.11	0.90	0.10	0.10	5.0	5.0	7.4	0.74	27.59	1.93	12	60.00	303.90	306.30	306.20	306.66	310.70	310.30	MH4 to CB5

Project File: Storm Sewer.stm

Number of lines: 7

Run Date: 1/9/2019

NOTES:Intensity = 35.29 / (Inlet time + 3.70) ^ 0.72; Return period =Yrs. 10 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	MH M1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	WQS1	0.40	0.20	0.46	0.15	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.12	4.14	0.07	2.44	0.0	Off
3	CB2	2.38	0.90	1.62	1.66	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.23	7.81	0.18	6.05	0.0	Off
4	CB3	1.32	0.74	1.16	0.90	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.20	6.56	0.14	4.81	0.0	3
5	CB4	1.79	0.00	1.05	0.74	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.19	6.22	0.13	4.47	0.0	4
6	MH4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	CB5	0.74	0.00	0.53	0.20	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.13	4.46	0.08	2.75	0.0	2

Project File: Storm Sewer.stm | Number of lines: 7 | Run Date: 1/9/2019

NOTES: Inlet N-Values = 0.016; Intensity = 35.29 / (Inlet time + 3.70) ^ 0.72; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	UG Det to MH M1	User																		0.00
2	MH M1 to WQS1	User																		5.00
3	WQS1 to CB2	TR55	0.240	150.00	2.90	3.00	17.63	121.00	18.00	UnPaved	6.85	0.29								
								149.00	3.00	UnPaved	2.79	0.89								
								39.00	3.00	Paved	3.52	0.18								19.00
4	CB2 to CB3	TR55	0.240	150.00	2.90	7.00	12.56	37.00	22.00	UnPaved	7.57	0.08								
								32.00	50.00	UnPaved	11.41	0.05								
								140.00	2.00	UnPaved	2.28	1.02								13.70
5	CB3 to CB4	TR55	0.240	148.00	2.90	13.00	9.70	88.00	3.00	UnPaved	2.79	0.52								
								78.00	1.00	Paved	2.03	0.64								10.90
6	UG Det to MH4	User																		0.00
7	MH4 to CB5	User																		5.00

Project File: Storm Sewer.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 7 | Date: 1/9/2019

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	24	4.92	303.90	306.20	2.00	3.14	1.57	0.04	306.24	0.047	4.000	303.90	306.20	2.00	3.14	1.57	0.04	306.24	0.047	0.047	0.002	0.15	0.01
2	18	4.95	303.90	306.21	1.50	1.77	2.80	0.12	306.33	0.223	40.000	304.20	306.30	1.50	1.77	2.80	0.12	306.42	0.223	0.223	0.089	1.58	0.19
3	15	4.77	304.20	306.49	1.25	1.23	3.89	0.24	306.72	0.546	29.000	304.50	306.65	1.25	1.23	3.89	0.24	306.88	0.546	0.546	0.158	1.50	0.35
4	12	2.89	304.50	307.00	1.00	0.79	3.69	0.21	307.21	0.661	107.000	305.60	307.71	1.00	0.79	3.69	0.21	307.92	0.661	0.661	0.707	0.50	0.11
5	12	1.79	305.60	307.81	1.00	0.79	2.28	0.08	307.89	0.252	101.000	306.90	308.07	1.00	0.79	2.28	0.08	308.15	0.252	0.252	0.255	1.00	0.08
6	24	0.73	303.90	306.20	2.00	3.14	0.23	0.00	306.20	0.001	4.000	303.90	306.20	2.00	3.14	0.23	0.00	306.20	0.001	0.001	0.000	0.67	0.00
7	12	0.74	303.90	306.20	1.00	0.25	0.94	0.01	306.21	0.043	4.000	306.30	306.66	0.36**	0.25	2.91	0.13	306.79	0.569	0.306	n/a	1.00	0.13

Project File: Storm Sewer.stm | Number of lines: 7 | Run Date: 1/9/2019

Notes: ; ** Critical depth. ; c = cir e = ellip b = box

APPENDIX D

Stormwater Quality Calculations

Water Quality Flow Calculations (Water Quality Structure WQS-1)

Residential Development

380 Tunxis Rd, West Hartford

WSE Project No. 2180652

Date: 1/8/2018

Refer to C.D.O.T. Drainage Manual Section 11.C-1

Compute Water Quality Volume:

$$WQV = \frac{(1") \times (R) \times (A)}{12}$$

WQV = Acre-Feet

R = 0.05 + 0.009 (I)

I = % Impervious

A= Acres

Note: Impervious area will not include roof runoff that ties directly into storm system. This is because roof runoff does not carry sediment and would not require treatment.

$$I = \frac{\text{Impervious Area}}{\text{Total Area}} = \frac{0.52}{2.42} = 21.5\ \%$$

$$R = 0.005 + 0.009 \times 21.5 = 0.24$$

A = 2.42 Acres

WQV = 0.049 Acre-Feet

Compute Water Quality Flow:

1. Compute NRCS Runoff Curve Number (CN)

$$CN = \frac{1000}{[\ 10 + 5P + 10Q - 10\ (Q^2 + 1.25QP)^{1/2}]}$$

P = Design Precipitation = 1"

$$Q = \frac{0.049 \text{ acre-feet} \times 12 \text{ in/ft}}{2.42 \text{ acres}} = 0.24 \text{ Watershed inches}$$

CN = 87.7

Water Quality Flow Calculations (Water Quality Structure WQS-1)

Residential Development

380 Tunxis Rd, West Hartford

WSE Project No. 2180652

2. Compute (T_c)

From Hydraflow Storm Sewer Computations, (Tc) = 19.4 minutes

0.32 hours

3. From Table 4-1 (TR-55)

For CN = 87.7 Ia = 0.281

From Exhibit 4-III (TR-55):

For Tc = 0.32 hours

Ia / P = 0.281

$q_{u\,=}$ 430 csm/in or ($cfs/m^2/in$)

Compute Water Quality Flow:

WQF = (q_u) x (A) x (Q)

$q_{u\,=}$ 430

A = 2.42 acres

0.00378 square miles

Q = 0.24 inches

WQF = 0.40 c.f.s. (see note)

Note: The Water Quality Structure shall be required to treat a water quality flow = 0.40 (c.f.s.)

The Water Quality Structure shall be required to bypass the design flow = 4.90 * (c.f.s.)

* From Hydraflow Design

CONTECH® ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

380 Tunxis Road
West Harford , CT

Area	**2.42 ac**	Unit Site Designation	**WQU**
Weighted C	**0.90**	Rainfall Station #	**36**
t_c	**19 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.08	34.3%	34.3%	0.17	0.17	32.7
0.16	21.4%	55.7%	0.35	0.35	19.2
0.24	13.3%	69.0%	0.52	0.52	11.2
0.32	8.7%	77.7%	0.70	0.70	6.8
0.40	5.1%	82.8%	0.87	0.87	3.7
0.48	2.8%	85.7%	1.05	1.05	1.9
0.56	2.6%	88.3%	1.22	1.22	1.6
0.64	1.8%	90.1%	1.39	1.39	1.0
0.72	1.2%	91.3%	1.57	1.40	0.6
0.80	1.3%	92.7%	1.74	1.40	0.6
1.00	1.7%	94.4%	2.18	1.40	0.6
2.00	3.8%	98.2%	4.36	1.40	0.7
3.00	1.1%	99.3%	6.53	1.40	0.1
4.00	0.7%	100.0%	8.71	1.40	0.1
					80.5
				Removal Efficiency Adjustment[2] =	0.0%
				Predicted % Annual Rainfall Treated =	94.9%
				Predicted Net Annual Load Removal Efficiency =	**80.5%**

1 - Based on 14 years of 15-minute data from NCDC station 4488, Mansfield Hollow Lake, Tolland County, CT
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

APPENDIX E

Operation & Maintenance Plan

OPERATION AND MAINTENANCE PLAN
380 TUNXIS ROAD, WEST HARTFORD

GENERAL

This section of the plan presents the operation and maintenance plan for the erosion and sediment control measures during construction and for the proposed stormwater management system. It also provides guidelines for when the stormwater system should be cleaned and associated recordkeeping.

EROSION AND SEDIMENT CONTROL MEASURES

The erosion control measures include the following items:

- Straw bales, and Silt Fence
- Permanent Erosion Control Matting
- Temporary Sediment Basin
- Temporary Swales /Berms
- Anti-Tracking Pad
- Vegetative Stabilization
- Temporary Soil Stockpiles
- Dust Control

During construction, the Contractor will be responsible for the operation and maintenance of the erosion and control measures. During this time all erosion and sediment structures shall be maintained in proper working order. Disturbed areas shall be kept to a minimum and shall only take place where immediately required to further construction. It is desirable from an erosion prevention concern to minimize the total disturbed area at any one time. Final grading and seeding shall take place as soon as practical.

A rain gauge shall be placed at the project in a workable location and monitored during rainfall periods until all disturbed areas are stabilized. In the event there is a rainfall greater than 1/2" in a 12-hour period, all erosion control measures shall be checked and repaired as required. If no rain gauge is used, all erosion control measures shall be checked after all rainfall events. A checklist will be filled out by the contractor each week.

All soil erosion and sediment control measures shall be installed as shown on the proposed site plans. It is the intent of this plan that soil erosion measures are the first to be installed and the last to be removed. Surface waters on and adjacent to the site and abutting properties are to be protected from degradation and sedimentation. If abutting properties or street right-of way are jeopardized by construction, it shall be the owner's or contractor's responsibility to protect those properties.

Soil erosion measures shall be inspected weekly and after significant storm events. Make all necessary repairs to facilities as soon as possible. Silt fences and straw bale barriers, temporary sediment trap, and construction swales which accumulate sediment and debris shall be cleaned and re-set.

STORMWATER SYSTEMS

The proposed site plan includes the following stormwater structures:

- Catch Basins with sumps, and Drainage Manholes
- Drainage Piping
- Water Quality Structure
- Subgrade Detention Chamber System
- Modified Riprap Splashpad & Level Spreader

The residential homeowner's association of the Tunxis Road development will be responsible for the operation and maintenance of the above stormwater structures. Checklists will be utilized during the inspection and cleaning process and kept on file in the maintenance office.

1. Catch Basins with sumps, and Drainage Manholes:

    a. Catch basins and manholes shall be completely cleaned of accumulated debris and sediments at the completion of construction.
    b. For the first year, catch basins, and manholes shall be inspected on a quarterly basis.
    c. Any accumulated debris within the catch basins/ manholes shall be removed and any repairs as required.
    d. From the second year onward, visual inspections shall occur twice per year, once in the spring and once in the fall, after fall cleanup of leaves has occurred.
    e. Accumulated debris within the catch basins/ manholes shall be removed and repairs made as required.
    f. Accumulated sediments shall be removed at which time they are within 12 inches of the invert of the outlet pipe.
    g. Any additional maintenance required per the manufacturer's specifications shall also be completed.

2. Drainage Piping

    a. All storm drainage piping shall be completely flushed of debris and accumulated sediment at the completion of construction.
    b. Unless system performance indicates degradation of piping, comprehensive video inspection of storm drainage piping shall occur once every ten years.
    c. Any additional maintenance required per the manufacturer's specifications shall also be completed.

3. Water Quality Structure (Hydrodynamic Separator)

    a. Hydrodynamic Separator shall be completely cleaned of accumulated debris and sediments at the completion of construction.

b. For the first year, the hydrodynamic separator shall be inspected on a quarterly basis.
c. Any accumulated debris within the hydrodynamic separator shall be removed and any repairs made to the unit as required.
d. From the second year onward, visual inspection shall occur twice per year, once in the spring and once in the fall, after fall cleanup of leaves has occurred.
e. Accumulated debris within the unit shall be removed and repairs made as required.
f. Accumulated sediments shall be removed at which time they are within 12 inches of the invert of the outlet pipe.
g. All inlets, outlets and components of the unit shall be inspected and cleared of debris. Any repairs shall be performed.
h. Any additional maintenance required per the manufacturer's specifications shall also be completed.

4. Subgrade Detention Chamber System

The Subgrade Detention Systems will have an Isolator Row which is wrapped in a specified filter fabric to trap sediment and will be inspected every three months and shall be cleaned once a year at a minimum. If during inspection, it is found that the sediment has accumulated within the Isolator Row, it shall be cleaned immediately with a jet-vac. The System's Isolator Row should be cleaned after the snow and ice removal seasons and before spring rainfall events.

5. Modified Riprap Splashpad & Level-Spreader

The Modified Riprap Splashpad & Level-Spreader will be inspected every three months and shall be cleaned once a year at a minimum. If during inspection, it is found that the sediment has accumulated within the splashpad and/or level-spreader, it shall be cleaned immediately. The splashpad and level-spreader should be cleaned after the snow and ice removal seasons and before spring rainfall events.

6. Street Sweeping

The parking areas will be swept twice a year. Once after the winter season has ended and once during the fall season.

Disposal of Debris and Sediment:

All debris and sediment removed from the stormwater structures shall be disposed of legally. There shall be no dumping of silt or debris into or in proximity to any inland wetlands.

Maintenance Records:

The Owners(s) must maintain all records (logs, invoices, reports, data, etc.) and have them readily available for inspection at all times.

STORMWATER SYSTEM INSPECTION CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

STRUCTURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
CATCH BASINS/MANHOLES/WATER QUALITY STRUCTURE				
WQS1				
CB2				
CB3				
CB4				
CB5				
STORM MH1				
STORM MH4				

SUBGRADE DETENTION SYSTEM				
ISOLATOR ROW				
24” HDPE MANIFOLD PIPING				
MODIFIED RIPRAP SPLASHPAD				
OUTFALL				
MODIFIED RIPRAP LEVEL-SPREADER				
OUTFALL				